Sauget Area 1 Superfund Site

Operable Unit 1

Sauget and Cahokia, St. Clair County, Illinois

Record of Decision

U.S. Environmental Protection Agency Region 5

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Table of Contents

Section **Page**

Figures (Cont'd)

Tables

Section **Page**

Tables (Cont'd)

Appendices

Part 1 – Declaration

1.1 – Site Name and Location

Sauget Area 1 Site
Operable Unit 1 (soil, sediment, surface water and groundwater contamination source areas)
CERCLIS ID# ILD980792006
Sauget and Cahokia, St. Clair County, Illinois

1.2 – Statement of Basis and Purpose

This decision document presents the remedy chosen by the U.S. Environmental Protection Agency (EPA) (the "Selected Remedy") for Operable Unit 1 (OU1) at the Sauget Area 1 Site in Sauget and Cahokia, St. Clair County, Illinois ("Site"). EPA chose the Selected Remedy for OU1 in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986[1], and, to the extent practicable, the National Contingency Plan (NCP)[2]. The decision is based on the Administrative Record for the Sauget Area 1 Site.

The State of Illinois concurs with the Selected Remedy.

1.3 - Assessment of Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 - Description of Selected Remedy

As set forth in Section 2.2 below, EPA and Site potentially responsible parties (PRPs) have already implemented extensive cleanup activities in Sauget Area 1. These actions were targeted to address some of the more toxic and mobile contaminant source materials formerly present at the Site, but other source materials remain. A "source material" is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration for contamination to groundwater, surface water or air, or acts as a source for direct exposure.

The Selected Remedy, referred to as remedial action for OU1, will address remaining contaminant source materials at the Site and will be the first of two remedial decisions and remedial actions for the Sauget Area 1 Site. EPA's overall strategy for cleaning up the Site is to first address contamination in the soil, sediment, surface water, and groundwater contamination

[1] 42 U.S.C. §§ 9601 to 9675
[2] 40 CFR Part 300

source areas, through this remedial action for OU1, which will be the final remedy for contaminated soils, sediments, and surface water and groundwater contamination source area at the Sauget Area 1 Site. Next, EPA plans to issue another ROD to address Sauget Area 2 soil, sediment, surface water, and groundwater contamination source areas. Then, area-wide groundwater contamination resulting from the contaminated soil and groundwater contamination source areas identified in the Sauget Area 1 and Sauget Area 2 Sites will be addressed as a separate remedial action, which will be set forth in a separate groundwater ROD for the Sauget Area 1 and 2 Superfund Sites. The groundwater ROD will be issued after the soil and groundwater contamination source area remedies are implemented for the Sauget Area 1 and 2 Sites.

The remedial action proposed in this ROD will be the final remedy for contaminated soils, sediments, surface water, and groundwater contamination source areas at the Sauget Area 1 Site. As described further in Section 2.1 below, Sauget Area 1 consists of: 1) Dead Creek Segments A, B, C, D, E, F, which run through the middle of the Site; 2) the "Transect Areas", which consist of residential, commercial, and undeveloped land located in the floodplain along alternating sides of Dead Creek; and 3) six disposal sites, consisting of three closed waste disposal areas (Sites G, H, and I), a backfilled impoundment (Site L), an inactive borrow pit (Site M), and a closed construction debris disposal area (Site N). EPA's Selected Remedy for OU1 at the Sauget Area 1 Site consists of:

- Recovery of pooled dense non-aqueous phase liquid (DNAPL) at Site I South
- Pulsed air biosparging (PABS) at residual DNAPL areas beneath Sites G, H, and I South
- 35 IAC § 724 compliant soil or crushed rock caps at Sites G, H, I South, and L
- Asphalt pavement cap at Site G West
- Utility relocation in utility corridor adjacent to Site H, south of Queeny Avenue
- Containment cell operation and maintenance
- Monitoring well network
- Institutional and access controls at Sites G, H, I South, and L
- No further action for Dead Creek Segments A, B, C, D, E, and F, Transect Areas, Borrow Pit Lake, Site M, Site I North, and Site N

This Selected Remedy for OU1 at the Sauget Area 1 Site addresses, among other wastes, principal threat wastes that are present on the Site. A "principal threat" waste is a source material that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. Principal threat wastes have been identified in the following two areas at the Site: pooled DNAPL that is present at Site I South, and subsurface soils contaminated with polychlorinated biphenyls (PCBs) and 2,3,7,8-TCDD-TEQ (dioxins)

with risks above EPA's principal threat waste threshold of $1x10^{-3}$ in the utility corridor along Queeny Avenue, adjacent to Site H. The Selected Remedy addresses these areas by applying PABS technology, treating the DNAPL recovered at Site I South through off-Site incineration, and relocating the utilities in the utility corridor to prevent unacceptable risk to utility workers during excavation/repair work.

To address the remaining low-level threat waste, engineering controls[3] in the form of engineered covers will be used. Engineered covers meeting the requirements of 35 IAC § 724 compliant caps will be installed over Sites G, H, I South, and L.

1.5 - Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). The Selected Remedy will treat DNAPLs through off-Site incineration of the pooled DNAPL recovered from Site I South and extensive in-situ aerobic biodegradation of contaminants of concern (COCs) in areas of Sites G, H, and I South using PABS systems targeting the residual DNAPL areas in the middle hydrogeologic unit (MHU) and deep hydrogeologic unit (DHU).

The Selected Remedy provides a significant degree of treatment. As much as 230,000 kilograms (kg) of contaminants will be treated through implementation of the Selected Remedy. By utilizing treatment in this manner as part of the remedy for the Site, the Selected Remedy satisfies the statutory preference for remedies to employ treatment as a principal element.

Because, however, this remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that would allow for unlimited use and unrestricted exposure, EPA will conduct a statutory review within five years after initiation of the remedial action and every five years subsequent, to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 – Data Certification Checklist

The following information is included in the *Decision Summary* section of this ROD. Additional information can be found in the Administrative Record for this Site.

[3] Engineering controls encompass a variety of engineered and constructed physical barriers (e.g., soil capping, sub-surface venting systems, mitigation barriers, fences) to contain and/or prevent exposure to contamination on a property.

Information Item	Location in ROD
Contaminants of concern and their respective concentrations	Section 2.7.2
Baseline risk represented by the contaminants of concern	Section 2.7
Cleanup levels established for contaminants of concern and the basis for these levels	Section 2.8
How source materials that constitute principal threats will be addressed	Sections 2.11 and 2.13
Current and reasonably anticipated future land use assumptions in the baseline risk assessment and the ROD	Section 2.7.1
Potential land and groundwater use that will be available at the Site as a result of the selected remedy	Section 2.6
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 2.9 and Appendix B
Key factor(s) that led to the selection of the remedy	Sections 2.10 and 2.12

1.7 - Authorizing Signatures

EPA, as the lead agency for the Sauget Area 1 Superfund Site (ILD980792006), formally authorizes this Record of Decision.

Richard C. Karl, Director
Superfund Division
EPA Region 5

9-24-13
Date

The State of Illinois Environmental Protection Agency (Illinois EPA), as the support agency for the Sauget Area 1 Site, has indicated that they will concur with this ROD. The State's concurrence letter will be added to the Administrative Record upon receipt.

Part 2 – Decision Summary

2.1 - Site Name, Location, and Brief Description

The Sauget Area 1 Site is located in the Villages of Sauget and Cahokia, in St. Clair County, Illinois, just east of the Mississippi River. Sauget Area 1 consists of Dead Creek, which runs through the middle of the Site, and six disposal sites, consisting of three closed waste disposal areas (Sites G, H, and I), a backfilled impoundment (Site L), an inactive borrow pit (Site M), and a closed construction debris disposal area (Site N). Dead Creek is an approximately 17,000 foot long, actively-managed storm water conveyance channel. The Creek runs through heavily-developed residential and commercial areas in its upper reaches and through agricultural and undeveloped areas in its lower reaches before it discharges to Prairie du Pont Creek at the Metro East Sanitary District lift station. Prairie du Pont Creek is located at the southern end of Dead Creek and routes all of the water from Dead Creek to the Mississippi River. As part of Illinois EPA's investigation of Sauget Area 1 in the 1980s, it subdivided Dead Creek into the following six segments (Creek Segments A, B, C, D, E, and F), thus the Sauget Area 1 Site consists of Dead Creek segments ("CS") A-F and Transect Areas and Sites G, H, I, L, M, and N. Figure 1 shows the location of the Sauget Area 1 sites.

The Sauget Area 1 Site is comprised of two separate areas, each of which is called an "operable unit" or "OU." OU1 consists of the soil, sediments, and surface water, including the groundwater contamination source areas, at the Sauget Area 1 Site. OU2 is the contaminated groundwater. EPA will address groundwater contamination in the Sauget Area after remedies are implemented for the soil, sediment, surface water and groundwater contamination source areas at both the Sauget Area 1 and 2 Sites.

EPA is the lead agency for the Sauget Area 1 Site. Illinois EPA serves as the support agency. PRPs investigated the Site, with EPA oversight, pursuant to the remedial investigation/feasibility study (RI/FS) required under a Superfund Administrative Order on Consent (AOC) signed on January 21, 1999. EPA intends to pursue responsible parties to fund or implement the remedy for OU1 set forth in this ROD. That action would be set forth in a remedial design/ remedial action (RD/RA) order or settlement for OU1.

2.2 - Site History and Enforcement Activities

Since the early 1900s, over 50 percent of the land on the east bank of the Mississippi River between Cahokia and Alton, Illinois has been used for heavy industrial purposes. Local area wastes, including chemical and industrial wastes from a variety of processes and sources, have been disposed of in Sauget Area 1 starting prior to the 1920s. Each site in Area 1 and segment in Dead Creek contain or formerly contained different types of wastes and/or have been subject to varying degrees of cleanup. The discussion below starts with Sites G, H, and I, which are sites that continue to have impacts on area groundwater. Remaining Sites and Dead Creek are discussed thereafter.

Sites G, H, and a portion of I are former industrial and municipal waste disposal areas. As a result, a variety of industrial and municipal wastes and soil contaminated by these wastes are present in Sites G, H, and I. These sites contain crushed drums, uncontained wastes, construction debris, and miscellaneous trash. Contaminants present in these sites include a variety of volatile and semi-volatile organic compounds such as chlorobenzene and 1,4-dichlorobenzene; herbicides such as pentachlorophenol; polychlorinated biphenyls (PCBs); 2,7,3,8-TCDD TEQS (dioxin); and metals.

Site G is located in the Village of Sauget, south of Queeny Avenue, west of Dead Creek and north of the containment cell constructed for the Sauget Area 1 Dead Creek Removal Action[4]. Approximately five acres in size, Site G was operated and served as a disposal area from approximately 1940 to 1966, and was subject to intermittent dumping thereafter until 1982. EPA contained and consolidated the waste on site in 1995. Currently the site is covered with a soil cap, covered with vegetation, enclosed by a fence, and not used. Waste areas also extend beyond the fenced area to the west (Site G West), under a parking lot and industrial storage building.

Site H is located in both the Village of Sauget and the Village of Cahokia, south of Queeny Avenue, west of Falling Springs Road and east of the Metro Construction Company property. It occupies approximately five acres of land and is connected to Site I South under Queeny Avenue. Industrial wastes were disposed at Site H from approximately 1931 to 1957. Currently, Site H is graded and grass covered, with some areas of exposed slag, and is not in use.

Site I is located in the Village of Sauget, north of Queeny Avenue, west of Falling Springs Road and south of the Alton & Southern Railroad. Site I covers approximately 19 acres, although not all of it contains waste. Site I has been divided into two areas, Site I South and Site I North, based on review of aerial photographs. Site I South is the southern portion of Site I and is connected to Site H and together they formerly were known as the "Sauget Monsanto Landfill". It received industrial and municipal wastes from approximately 1931 to 1957. Site I North is the northern portion of Site I and was not part of the "Sauget-Monsanto Landfill" based on historical aerial photos. Currently, Site I is fenced, graded, covered with crushed stone, and used for equipment and truck parking.

Contamination present beneath Sites G, H, and I South contributes to a large plume of chlorinated organic-contaminated groundwater which flows toward the Mississippi River. Sites G, H, and I South also contribute to an area of residual dense non-aqueous phase liquids

[4] In 1999, EPA issued a CERCLA Unilateral Administrative Order (UAO) for Removal Action to PRP Monsanto Company and Solutia Inc., to replace culverts on Dead Creek to eliminate potential risks associated with flooding and to eliminate associated adverse ecological impacts. This work was completed in 2000. In 2000, EPA modified the UAO to address contamination in Dead Creek. This modified UAO required the removal of sediments from the Creek and construction of a Toxic Substances Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA)-compliant on-Site double lined containment cell, which includes a leachate collection and treatment system. Approximately 58,300 cubic yards of impacted sediments and soils from Dead Creek have been placed in the containment cell. The cell will be closed by Monsanto Company and Solutia, Inc, per the 1999 Removal Action UAO. Long-term operation and maintenance (O&M) of the cell is part of the Selected Remedy for OU1.

(DNAPL[5])[6] in the aquifer matrix, which is present under and close to the disposal areas. The residual DNAPL located beneath Sites G, H, and I South acts as an on-going source of contamination that can dissolve in groundwater.

Before reaching the River (which is approximately one mile west of Sauget Area 1), some of the mass of chlorinated organics which is dissolved in the groundwater is removed by processes that occur naturally in the aquifer, such as biodegradation. Further, of the portion of the Sauget Area 1 plume that reaches the River, regional groundwater studies show that over 70%[7] of the contaminant mass is captured by the Sauget Area 2 groundwater migration control system (GMCS)[8], which was installed by the Sauget Area 2 Site PRPs as an interim groundwater remedy under a CERCLA Unilateral Administrative Order (UAO) issued by EPA. The GMCS is situated in Sauget Area 2, next to the Mississippi River bank. The GMCS intercepts and captures an estimated 210 million gallons of contaminated groundwater a year, which is pumped to the American Bottoms Regional Water Treatment Facility (ABRTF) in Sauget. The groundwater is treated at the ABRTF and ultimately discharged to the Mississippi River in compliance with the terms and conditions of the ABRTF's National Discharge Pollutant Discharge Elimination System (NPDES) permit issued under the Clean Water Act.

Site L is located in the Village of Cahokia, immediately east of Dead Creek and south of the Metro Construction Company property. Site L was used for the disposal of wash water from truck cleaning operations from approximately 1971-1981. The trucks were used for bulk-chemical transport. The area of the wash water impoundment was approximately 7,600 square feet of the approximately 1 acre site. Site L is now covered by cinders and used for equipment storage.

Site M is located in the Village of Cahokia, along the eastern side of Dead Creek at the western end of Walnut Street. Originally used as a borrow pit in the 1940s, Site M was connected to Dead Creek through an opening and contaminants were carried to the site from water from the creek. An estimated 3,600 cubic yards of contaminated sediments was located in this borrow pit prior to the site being remediated, backfilled, and fenced during the 2000 Sauget Area 1 Dead Creek Removal Action. Site M is currently not in use.

Site N, which is located on property formerly owned by the H. H. Hall Construction Company, was primarily used for disposal of construction debris. The waste materials found in Site N

[5] DNAPLs are "dense non-aqueous phase liquids" that are denser than water. Because of their physical and chemical properties, they tend to sink vertically to the bottom of the groundwater aquifer and do not mix easily with water, acting as a continual source of groundwater contamination until they are removed or dissipate.

[6] Residual phase DNAPL is trapped in the pore spaces between the soil particles, and cannot be easily moved hydraulically.

[7] The 2012 updated regional groundwater flow and transport model (GSI, 2012) was used to quantify the percent of dissolved constituent mass flux captured by the groundwater migration control system.

[8] The installation of the Sauget Area 2 Groundwater Migration and Control System (GMCS) was required by EPA as an interim groundwater remedy for the Sauget Area 2 site. This system is comprised of a 3,300 ft long "U"-shaped, fully penetrating barrier wall located downgradient of Sauget Area 2, Site R, and Sauget Area 1, which extends from approximately 3 feet below ground surface to the top of bedrock and includes three groundwater extraction wells on the upgradient side of the barrier wall.

included soil, brick, concrete, metal, tires, and wood, as well as some empty and partially empty crushed drums. Site N is currently not in use.

Dead Creek, which runs through the middle of Sauget Area 1, is an approximately 17,000 foot long, actively-managed storm water conveyance channel. The creek runs through heavily-developed residential and commercial areas in its upper reaches and through agricultural and undeveloped areas in its lower reaches before it discharges to Prairie du Pont Creek at the Metro East Sanitary District lift station. Prairie du Pont Creek is located at the southern end of Dead Creek and routes all of the water from Dead Creek to the Mississippi River. As part of Illinois EPA's investigation of Sauget Area 1 in the 1980s, it subdivided Dead Creek into the following six segments (Creek Segments A, B, C, D, E, and F):

- Creek Segment (CS) A was the northernmost segment of the creek and was approximately 1,800 feet long and 100 feet wide running from the Alton & Southern Railroad to Queeny Avenue. This segment of the creek originally consisted of two holding ponds, which were periodically dredged. For several years, CS-A and available downstream creek segments (e.g., ones that were not blocked off) received direct wastewater discharges from industrial sources and served as a surcharge basin for the Village of Sauget (formerly Village of Monsanto) municipal sewer collection system.
- Creek Segment B extends for approximately 1,800 feet from Queeny Avenue south to Judith Lane. Sites G, L, and M of the Sauget Area 1 Site border this creek segment. Land use surrounding CS-B is primarily commercial with a small residential area near the southern end of this segment. Agricultural land lies to the west of the creek and south of Site G.
- Creek Segment C extends for approximately 1,300 feet from Judith Lane south to Cahokia Street. Land use is primarily residential along both sides of CS-C.
- Creek Segment D extends for approximately 1,100 feet from Cahokia Street to Jerome Lane. Land use is primarily residential along both sides of CS-D.
- Creek Segment E extends approximately 4,300 feet from Jerome Lane to the intersection of Illinois Route 3 and Route 157. Land use surrounding CS-E is predominantly commercial with some mixed residential use.
- Creek Segment F is approximately 6,500 feet long and extends from Route 157 to the Old Prairie du Pont Creek. CS-F is the widest segment of Dead Creek and a large wetland area extends several hundred feet out from both sides of the creek within this segment.

In the mid-1980s, Illinois EPA conducted a detailed expanded Site investigation to determine levels of contamination present in the Sauget Area sites[9]. Since this investigation, extensive cleanup activities have been implemented in Sauget Area 1.

[9] Ecology and Environment, Inc., under Illinois EPA contract, conducted the Expanded Site Investigation of the Sauget Area Sites from 1985 to 1987.

Starting in 1990, Cerro Flow Products remediated Dead Creek Segment A under a plan approved by Illinois EPA. Under this plan, Cerro excavated approximately 27,500 tons of contaminated sediments out of Dead Creek, which it disposed of in off-Site disposal facilities. After removal of the contaminated sediments, an HDPE vapor barrier was installed and then Creek Segment A was backfilled and covered with crushed gravel.

In 1995, EPA performed a removal action at Site G. This removal action involved the following activities: soil sampling inside and outside the fenced area; excavation of approximately 25 cubic yards of soils along Queeny Avenue sidewalk and approximately 50 cubic yards of soils from the Wiese parking lot; placement of these soils within the fenced area; solidification of two oil pits located on the northeast and central east portions of the site; installation of a shallow barrier wall on the eastern boundary of the site; and installation of a clean soil cover approximately 18 – 30 inches thick to cover the wastes inside the fenced area. The soil layer covered the entire fenced area except for the southeast and southwest corners and the central south portion of the fenced area.

In 1999, EPA issued a UAO for the Dead Creek Removal Action to PRPs Monsanto Company and Solutia Inc., to replace culverts on Dead Creek to eliminate potential risks associated with flooding and to eliminate associated adverse ecological impacts. This work was completed in 2000. In 2000, EPA modified the UAO to address contamination in Dead Creek. This modified UAO required the following: removal of sediments from Creek Segments B, C, D, E, and Site M and construction of a Toxic Substances Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA)-compliant on-Site double lined containment cell, which includes a leachate collection and treatment system. In 2001, EPA amended the UAO to include remediation of contaminated sediments in Creek Segment F and Borrow Pit Lake.

The PRPs implemented the amended UAO, with work beginning in 2000. Under the terms of the UAO, the PRPs, with EPA oversight, constructed a TSCA and RCRA-compliant on-Site containment cell adjacent to Dead Creek Segment B. Pursuant to the Order, the containment cell has a double liner and a leachate collection and treatment system. Under the UAO, approximately 46,000 cubic yards of sediment were excavated from Dead Creek Segments B, C, D, E, F, and Site M in 2001 and 2002 and placed in the containment cell. The containment cell will be closed by Monsanto Company and Solutia, Inc, in accordance with the UAO. Long-term operation and maintenance (O&M) of the containment cell is part of the Selected Remedy for Sauget Area 1, OU1 set forth in this ROD.

After completion of Dead Creek sediment removal, the PRPs sampled creek bottom soils throughout Dead Creek and in Borrow Pit Lake. Pursuant to the amended UAO, the creek bottom soils containing contamination exceeding target risk levels were removed and placed in the containment cell in 2005 through 2006. In total, during the second phase of sediment remediation activities under the UAO, the PRPs removed an additional 5,000 cubic yards of contaminated creek-bottom soil from CS-B through CS-F of Dead Creek and 7,300 cubic yards of contaminated sediment from Borrow Pit Lake. Finally, pursuant to the Order, the PRPs installed a polysynthetic liner in CS-B, for the purpose of providing further protection from

potential leaching from the disposal areas adjacent to the northern portion of CS-B, which might act to re-contaminate this area and the Creek. This action was completed in 2008.

In 1999, EPA also entered into an AOC with PRPs Monsanto Company and Solutia Inc., to conduct an RI/FS to investigate and assess what cleanup was required or remained to be done at the Site after the above referenced removal actions were completed. From 1999 to 2000, under the AOC and with EPA and Illinois EPA oversight, the PRPs conducted extensive Site investigations of the disposal areas, downgradient groundwater, surface water, air, and soil.

In September 2002, EPA signed the ROD for the groundwater operable unit (OU2) of the Sauget Area 2 Superfund Site, which selected an interim groundwater remedy for the Sauget Area 2 Site to address the release of contaminated groundwater into the Mississippi River. Subsequently, in October 2002, EPA issued a UAO to the Sauget Area 2 Site PRPs for Remedial Design and Interim Remedial Action associated with the Sauget Area 2 interim groundwater remedy. The two main components of the remedial action called for in the Sauget Area 2 OU2 interim ROD were the construction of the barrier wall and the installation of three groundwater recovery wells. The wall along with the extraction wells are referred to as the Groundwater Migration Control System, or GMCS. Although the three extraction wells are intended to be the principal groundwater control measure, the barrier wall serves to reduce the volume of uncontaminated groundwater flowing into the extraction system from the Mississippi River during operation of the extraction wells, thereby reducing operation and maintenance (O&M) costs by reducing the volume of water treated. Construction of the interim remedy began in 2003 and was completed in 2005.

The Sauget Area 2 GMCS was designed to abate adverse impacts on the Mississippi River resulting from the discharge of groundwater from Sauget Area 2 Sites O, Q North, R, and S; the former Clayton Chemical facility site; Sauget Area 1 Sites G, H, I South, and L; the southern portion of the W.G. Krummrich Facility (which is also being addressed under RCRA Corrective Action), and other industries in the Sauget area.

Between 2002 and 2007, the PRPs conducted follow-up and supplemental investigations related to principal threat waste, treatability of DNAPLs in groundwater, floodplain soils, leachability of Dead Creek soils, and mass flux of contaminants from the landfills to groundwater, as well as extensive assessments of human health and ecological risks. EPA also conducted its own investigations in some areas during this period. Results of all of these studies were evaluated and compiled into the Final RI/FS Report for Sauget Area 1 dated November 6, 2012.

As set forth in the RI/FS Report for OU1, Dead Creek, Site M, and Borrow Pit Lake sediments and creek bottom soils have been cleaned-up; however, contamination remains within OU1 at Site G, H, I South, and L. This ROD sets forth EPA's approach for addressing the contaminated soils and groundwater source areas throughout OU1 that still require cleanup.

2.3 – Community Participation

EPA made available to the public the RI/FS Report and the Proposed Plan for the Sauget Area 1 Site in February 2013. These documents can be found in the Administrative Record for the Site.

The Administrative Record is maintained at the EPA Region 5 Docket Room, 77 West Jackson Boulevard (7th Floor) Chicago, Illinois, and the Cahokia Public Library, 140 Cahokia Drive, Cahokia, Illinois. The Proposed Plan set forth the remedial alternatives for the Site and EPA's proposed remedial action for OU1. After issuing the Proposed Plan, EPA held a public comment period between February 27 and March 28, 2013. When the Proposed Plan was issued, EPA mailed a fact sheet to area residents informing them about the Proposed Plan. The fact sheet advised residents that the RI/FS Report and Proposed Plan were available for viewing at the public repositories. The fact sheet included the date, time, and location of the public meeting. At the public meeting on March 5, 2013, EPA and Illinois EPA representatives answered questions about the Site and the remedial alternatives. EPA's responses to the comments received during the public comment period are included in the *Responsiveness Summary*, which is Part 3 of this Record of Decision.

2.4 - Scope and Role of Operable Unit or Response Action

As with many Superfund sites, the problems at the Sauget Area 1 Site are complex. As a result, EPA has organized the work into two operable units (OUs):

- Operable Unit 1: Contamination in on-Site soils, sediments, surface water/ groundwater contamination source areas (DNAPL and residual DNAPL)
- Operable Unit 2: Contamination of the groundwater aquifer

The Selected Remedy, referred to as remedial action for OU1, will be the first of two remedial decisions and remedial actions for the Sauget Area 1 Site. EPA's overall strategy for cleaning up the Site is to first address soil, sediment, surface water, and groundwater contamination source areas through this remedial action for OU1, which will be the final remedy for contaminated soils, sediments, and surface water and at the Site. Area-wide groundwater contamination resulting from the contaminated soil and groundwater contamination source areas present in the Sauget Area 1 and Sauget Area 2 Sites will be addressed as a separate remedial action, which will be proposed and set forth in a separate groundwater ROD for the Sauget Area 1 and 2 Superfund Sites, after the remedies set forth in the soil and groundwater source area RODs for Areas 1 and 2 are implemented.

2.5 – Site Characteristics

2.5.1 - Conceptual Site Model

To guide identification of appropriate exposure pathways and receptors for evaluation in the risk assessment, a conceptual site model (CSM) for human health was developed. The purpose of the conceptual site model is to provide a framework with which to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors.

A general identification of exposure pathways, exposure routes, and receptors is provided in the conceptual site model as illustrated in Figure 2. A more detailed discussion of the receptor/area matrix for the Sites (G, H, I, L, and N), Dead Creek, Site M, and Borrow Pit Lake, and the Transect Areas is provided below.

Sites

The Sauget Area 1 Sites (G, H, I, L, and N) have been used for industrial purposes for many years (since the 1930s or earlier). The sites are zoned commercial/industrial and it is likely that the sites will continue to be used well into the reasonably foreseeable future for commercial/industrial purposes. Therefore, the sites were evaluated for non-residential use scenarios in the Site-wide human health risk assessment (HHRA) (ENSR, 2001). Additionally, at the request of EPA, the PRPs evaluated Site N for both a non-residential, as well as a hypothetical future residential scenario, to determine whether or not potential risks remained at the Site under the residential use scenario. This was done because if the investigation found no potential risks under a potential residential use scenario, the Site could be determined to have unlimited uses and unrestricted exposures.

Receptors were identified for the sites based on the CSM and the constituents of potential concern (COPCs) identified in media in the sites. COPCs are a subset of the complete list of constituents detected in site media that are carried through the quantitative risk assessment process. COPCs were identified in soils, leachate, and groundwater in Sites G, H, I South, and L. COPCs were identified in Site N surface soil for the residential scenario only.

A resident receptor was evaluated in the Site-wide HHRA (ENSR, 2001) for potential exposure to COPCs in surface soils via incidental ingestion and dermal contact, and via inhalation of COPCs that may be suspended as dusts from soils in Site N. Inspection of the area indicated that some residences have vegetable gardens. Therefore, a produce consumption pathway was included in the site-wide HHRA as COPCs may be taken up by plant material and subsequently ingested. However, COPCs for this pathway were not identified in Site N.

An on-Site outdoor industrial worker and a trespassing teenager were evaluated in the Site-wide HHRA (ENSR, 2001) for potential exposure to COPCs in surface soil via incidental ingestion and dermal contact, via inhalation of COPCs that may be suspended as dusts from soils, and via inhalation of volatilized COPCs into outdoor air from underlying groundwater. No volatile COPCs were identified in the surface soils.

An on-Site construction/utility worker exposure scenario was evaluated in the Site-wide HHRA (ENSR, 2001) for
potential exposure to COPCs in surface and subsurface soil via incidental ingestion and dermal contact, and via inhalation of particulates suspended during excavation activity.

Due to the presence of volatiles in the subsurface of the sites, an on-Site indoor industrial worker was evaluated in the Vapor Intrusion HHRA (AECOM, 2009a) for potential exposure to COPCs via inhalation of volatile constituents present in indoor air. This vapor intrusion analysis was conducted based on a tiered evaluation. The Sauget Village Hall adjacent to Site I South, the

Cerro Guard House in Site I South, the Cerro Control Center west of Site I South, and the Weise building west of Site G were included in the evaluation.

Due to the potential presence of waste materials in the utility corridor that runs along Queeny Avenue adjacent to Sites H and I South, a utility worker was evaluated for potential exposure to COPCs in soils and wastes via incidental ingestion and dermal contact, and inhalation of particulates and volatiles suspended during excavation activity in the Utility Corridor HHRA (ENSR, 2008). The area where wastes may extend into the utility corridor is currently underneath pavement (Queeny Avenue). The pavement prevents direct contact with materials that may be present. However, due to the presence of utility lines in the area, it is possible that at some point in the future, utility work will require excavation in this area. The existing utility adjacent to Site H is a pipeline that is owned by Explorer Pipeline. It is a 14-inch diameter pipe at a depth of 3 1/2 feet below ground surface (bgs). The existing utility line along Site I South is a 4-inch steel line gas line at a depth of 2 1/2 feet bgs. Therefore, there is a potential for human contact (utility worker) with the soils via incidental ingestion, dermal contact, and inhalation. Contact with groundwater is not expected because the depth to groundwater is about 7 feet deeper than the depth of the utilities.

Dead Creek, Site M, and Borrow Pit Lake

Borrow Pit Lake is located on private property, and access is uncontrolled. Therefore, recreational fishing may occur in Borrow Pit Lake. Borrow Pit Lake and the majority of Creek Segment F that were not included in the sediment removal action conducted in 2000-2001 were evaluated as one area in the Site-wide HHRA (ENSR, 2001).

COPCs were identified in sediment but not in surface water. Therefore, a recreational receptor (i.e., teenager) could be exposed to COPCs in sediment of Creek Segment F and Borrow Pit Lake while wading or swimming. This scenario was evaluated in the Site-wide HHRA (ENSR, 2001).

One COPC was identified in fish tissue collected from Borrow Pit Lake. Therefore, a recreational fisher receptor potentially exposed to COPCs in sediment while wading and via ingestion of fish was evaluated in the Site-wide HHRA (ENSR, 2001).

Creek bottom soils in Site M and Creek Segments B through F were collected and analyzed after the Dead Creek Removal Action, conducted in 2000-2001, was complete. These data were evaluated in the Dead Creek Bottom Soils HHRA (ENSR, 2006). COPCs were identified in creek bottom soil in Creek Segments B, D, E, F, and Site M.

Access to Dead Creek is generally uncontrolled except for Creek Segment B, which is secured with a fence. As sediment was removed from Site M, it was backfilled with soil from an adjoining property, re-graded to drain to Creek Segment B, vegetated, and surrounded by a fence. Therefore, a recreational receptor (i.e., child or teenager) could be exposed to COPCs in creek bottom soil of Creek Segment B through Creek Segment F. Given that access to Site M is limited, it is unlikely that any recreational receptor would gain access. However, it was assumed

that a recreational teenager could climb the fence and could be exposed to creek bottom soils in Site M. It was assumed that a recreational child could not access Site M.

Due to the presence of underground utility lines in several of the Creek Segments, it is possible that excavation work may occur in the future. Therefore, a construction worker receptor could be exposed to COPCs in creek bottom soil of Site M and Creek Segment B through Creek Segment F during excavation.

Transect Areas

The transect areas consist of residential, commercial, and undeveloped land located in the flood plain along alternating sides of Dead Creek. Therefore, both residential and non-residential exposure scenarios were evaluated for these areas in the Site-wide HHRA (ENSR, 2001). The purpose of sampling transects along Dead Creek was to determine if there was a concentration gradient of constituents extending out from the creek due to overbank flooding of the creek. Transect sampling data indicate Dead Creek is not serving as a source of constituents to soils in the surrounding flood plain.

An outdoor industrial worker was evaluated in the Site-wide HHRA (ENSR, 2001) for potential exposure to COPCs in surface soil via incidental ingestion and dermal contact, and via inhalation of COPCs that may be suspended as dusts from soils.

A construction worker receptor was evaluated in the Site-wide HHRA (ENSR, 2001) for potential exposure to COPCs in surface and subsurface soil via incidental ingestion and dermal contact, and via inhalation of particulates suspended during excavation activity. Construction/utility work is assumed to occur up to depths of 30 feet below ground surface. Due to the shallow depth of groundwater, the construction/utility worker may contact groundwater during excavation. Therefore, the construction worker was assumed to be exposed to COPCs in groundwater via incidental ingestion and dermal contact with standing water in an excavation trench. Volatile inhalation was not included as no volatiles were identified as COPCs in soil or groundwater in the transect area.

A resident receptor was evaluated in the Site-wide HHRA (ENSR, 2001) for potential exposure to COPCs in surface soils via incidental ingestion and dermal contact, and via inhalation of COPCs that may be suspended as dusts from soils (volatile inhalation was not included as no volatile COPCs were identified). Inspection of the area indicated that some residences have vegetable gardens. As COPCs may be taken up by plant material and subsequently ingested, a produce consumption pathway was included in the HHRA. A trespassing teenager receptor was not evaluated in the Transects and Site N due to the inclusion of the residential scenario in these areas as the residential scenario provides a more conservative evaluation.

2.5.2 - Overview of Site

The Sauget Area 1 Site is situated in a floodplain of the Mississippi River called the American Bottoms, and is located in the southwestern section of the American Bottoms floodplain. More

specifically, it is situated south of East St. Louis, and is approximately three-quarters to one mile east of the eastern bank of the Mississippi River.

The Mississippi River, bordering the American Bottoms to the west, is the major surface-water body draining the area. Locally across Sauget Area 1 the topography consists of nearly flat bottomland. Dead Creek, a channelized stream, serves as the main conduit for surface water drainage through Sauget Area 1. The creek flows to a floodway south of Cahokia (Prairie du Pont Creek), which in turn discharges to the Cahokia Chute of the Mississippi River. Surface drainage across the Site is generally toward Dead Creek.

Collectively, Sites G, H, I South, I North, L and N contain an estimated 796,000 cubic yards of soil and waste. Site I South is the largest disposal area with an estimated waste volume of 355,000 cubic yards followed by Site H with 157,000 cubic yards, and Site G plus G West with 107,000 cubic yards. All three of these sites were formerly used for industrial/municipal waste disposal. Inert material, rather than waste, was placed at Site I North to level the area for truck trailer parking, which contains an estimated volume of 56,800 cubic yards of material. Site L is a backfilled wastewater impoundment with an estimate waste volume of 17,500 cubic yards. Site N was used to dispose of construction debris and contains an estimated volume of 103,000 cubic yards.

2.5.3 - Geologic and Hydrogeologic Setting

The stratigraphy beneath the Site is much like that of the rest of the floodplain. The Cahokia Alluvium is about 30 feet thick and exists as a fine, silty sand that is gray and brown in color. Below this, the unconsolidated deposits of the Henry Formation are present.

Locally, the Henry Formation is characterized by medium-to-coarse sand that becomes coarser and more permeable with depth. The depth to bedrock (below ground surface) ranges from 140 feet near the river to about 100 feet on the east side of the Sauget Area 1 Site. The groundwater level is currently between 10 to 20 feet below ground surface, but fluctuates during times of heavy and light precipitation. Figure 3 presents a generalized geologic cross-section.

Three distinct hydrogeologic units can be identified in the Sauget Area 1 and Area 2 Sites: 1) a shallow hydrogeologic unit (SHU); 2) a middle hydrogeologic unit (MHU), and 3) a deep hydrogeologic unit (DHU). The 30 foot thick SHU includes the Cahokia Alluvium and the uppermost portion of the Henry Formation. This unit is primarily unconsolidated, fine-grained silty sand with low to moderate permeability. The 40 foot thick MHU is formed by the upper to middle, medium to coarse sand portions of the Henry Formation. It contains higher permeability sand than found in the overlying shallow hydrogeologic unit, and these sands become coarser with depth. At the bottom of the aquifer is the DHU, which includes the high permeability, coarse-grained deposits of the lower Henry Formation. This zone is estimated to be about 30 to 40 feet thick. Groundwater beneath Sauget Area 1 generally flows from east to west, toward the Mississippi River.

2.5.4 - Sampling Strategy

In order to streamline the Sauget Area 1 remedy selection and implementation, the January 21, 1999 AOC divided the Site characterization and remedy evaluation process into two components: 1) an Engineering Evaluation/Cost Analysis (EE/CA) for soil, sediment, surface water, and air and 2) a Remedial Investigation/Feasibility Study (RI/FS) for groundwater. The June 21, 1999 UAO for a time-critical removal action in Dead Creek was modified on May 31, 2000 to include sediment removal in Dead Creek Segments B, C, D, and E, and amended on August 29, 2001 to include removal of sediments from Creek Segment F including the Borrow Pit Lake. As a result a streamlined remedy selection process was no longer necessary because removal of sediments from Dead Creek in 2001/2002 addressed any immediate threats to public health and the environment.

Completion of human health risk assessments (ENSR, 2001, 2002, and 2006) and ecological risk assessments (Menzie-Cura, 2001 and 2002) for Sauget Area 1 confirmed that any immediate threats to public health and the environment were controlled by the Dead Creek Removal Action. Therefore, further Site characterization and remedy evaluation were no longer appropriate. As a result, the RI focus was expanded to include environmental media originally included in the EE/CA but not addressed by the Dead Creek Removal Action (i.e., soil and air).

The following summarizes the RI and Supplemental Investigations completed and included in the RI/FS Report.

Remedial Investigations

Disposal Area Characterization Sampling- Surface soil and subsurface soil/waste samples were collected from borings taken at each of the disposal areas (Sites G, H, I North, I South, L and N) in order to characterize the depth and types of wastes present at each site and to evaluate potential exposures for the human health risk assessment including the outdoor industrial worker and construction/utility worker exposure scenarios. Additional activities included determination of disposal area boundaries using historical air photo analysis, soil gas surveys and test trenching and identification of buried tanks and/or drums using magnetometer surveys and test trenches. Ambient air sampling was conducted upwind and downwind of Sites G, H, I North, I South, and L to determine the tendency of Site constituents to enter the atmosphere and local wind patterns. Air sampling data were subsequently evaluated in the HHRA outdoor industrial worker, construction/utility worker and trespassing teenager exposure scenarios.

Treatability studies were planned for disposal area soils and wastes in order to identify any characteristics that would prevent their treatment using off-Site incineration or on-site thermal desorption technologies. Vendors of these technologies indicated that these materials were not amenable to treatment by incineration or thermal desorption. Therefore, the planned disposal area soil and waste treatability studies were not performed. Leachate treatability studies were performed to determine the appropriate combination of physical/chemical and/or biological

treatment processes needed to achieve pretreatment requirements for discharge to the American Bottoms Regional Treatment Facility (ABRTF).

Groundwater Sampling - Groundwater samples were collected to define the horizontal and vertical distribution of constituents in the alluvial aquifer beneath and downgradient of Site I South and Site I North and Sites G, H, and L. Groundwater samples also provided information for two HHRA exposure scenarios: as volatilization from groundwater to outdoor air for the outdoor industrial worker and construction/utility worker; and as vapor intrusion into buildings for the indoor industrial worker. In addition, groundwater samples were collected from weathered bedrock beneath Sites G, H, and I South to determine the vertical extent of migration from these source areas.

Alluvial aquifer groundwater samples were also collected downgradient of Creek Segment B and Site M. Site N was not included in the groundwater sampling program because historical information on waste disposal activities and historical soil and groundwater data did not indicate a potential for groundwater impact from this disposal area.

Shallow groundwater samples were collected from non-potable domestic water-supply wells located along Judith Lane and other nearby streets to assess any potential adverse impacts of residential use of groundwater for lawn and garden watering scenarios in the HHRA.

Groundwater flow direction was determined by installing water-level measurement piezometers in each of the three hydrogeologic units present in Sauget Area 1 and measuring groundwater-level elevations. Aquifer hydraulic conductivity was measured by conducting slug tests in the piezometers. Aquifer grain size analyses were also performed on soil samples collected from each hydrogeologic unit.

Surface Water, Sediment, and Biota Sampling - Surface water, sediment, and biota samples were collected in Dead Creek, Borrow Pit Lake, Prairie du Pont Creek, and two reference areas in 1999/2000, prior to the Dead Creek Removal Action, to determine the extent of downstream migration of Site-related constituents and provide information for use in the HHRA (recreational teenager and recreational fishing exposure scenarios) and the ecological risk assessment (potential ecological receptor exposures).

Biota sampling included collection of tissue samples and performance of sediment bioassays. Tissue samples were collected from fish (large-mouth bass, brown bullheads and forage fish), clams, shrimp, and plants in order to evaluate the impact of Site-related constituents on potential ecological receptors (i.e., large-mouth bass, great blue herons, bald eagles, mallard ducks, muskrats, and river otters). Fish filet data were also used in the HHRA (recreational fishing scenario). Bioassays were performed on sediment samples using sensitive test organisms (Hyallela azteca and Chironomous tentans) to determine the effects of impacted sediments on organism survival, growth, and reproduction.

Transect Area Sampling - Surface and subsurface floodplain soil samples were collected within the developed area of Dead Creek bounded by Queeny Avenue on the north, Falling Springs

Road on the east, Route 157 on the south and Route 3 (Mississippi Avenue) on the west. Floodplain soil samples were collected in areas susceptible to flooding to determine the extent of overbank transport of impacted sediments. There is no historical knowledge of overbank flooding of Dead Creek. Overbank flooding of Dead Creek is very unlikely because the Metro East Sanitary District pumping station at Prairie du Pont Creek controls discharge from Dead Creek. Floodplain soil sampling was also performed to assess airborne transport of impacted sediments because Dead Creek is an intermittent stream that is frequently dry during warm weather conditions.

Information from the floodplain soil sampling program was used to determine the extent of migration due to overbank flooding and wind-blown dust deposition. In addition, surficial and subsurface soil information was used in the HHRA to evaluate outdoor industrial worker, construction/utility worker and residential exposure scenarios and in the ecological risk assessment (ERA) to assess risks to terrestrial organisms. Background soil samples were also collected as part of this sampling program.

Supplemental Investigations

After completion of the Remedial Investigation, a number of supplemental investigations (SI) were performed to collect information needed to complete the Sauget Area 1 site characterization process. Most of these supplemental investigations focused on source areas but additional investigations were performed for groundwater and creek bottom soil.

Source Area Investigations - EPA performed test trenching and soil, waste, and groundwater sampling at Sites G, H, I North, I South, L and N in 2002 and 2003 to look for buried tanks and drums and to identify the presence of contaminants in these disposal areas (Tetra Tech, 2003a, 2003b and 2003c). The PRPs, with EPA oversight, performed the following five supplemental investigations in Sauget Area 1 to characterize source areas and migration pathways that were not evaluated during the Remedial Investigation:

- DNAPL Characterization and Remediation Study at Sites G, H, and I South in 2004/2005 (GSI, 2006c) to identify the volume of DNAPL-containing aquifer materials beneath these sites;
- DNAPL Recovery Study at Site I South in 2007/2008 (GSI, 2008a) to determine whether or not pooled DNAPL at Site I South was recoverable;
- Flux Study at Sites G, H, I South, and L in 2005 (GSI, 2005) to determine mass flux from the disposal areas and the underlying DNAPL-containing aquifer matrix and identify the primary source of Site-related constituents entrained in groundwater and migrating dowgradient;
- Soil Vapor Investigation in 2006 (Golder Associates, 2007a) to sample soil vapors at the Sauget Village Hall, Cerro Flow Products and Wiese, Inc. and provide information for the HHRA (vapor intrusion into occupied buildings); and
- Utility Corridor Investigation in 2007 (Golder Associates, 2008) to characterize soils and wastes present in the utility corridors on either side of Queeny Avenue adjacent

to Sites I South and H and provide information for the HHRA (construction/utility worker exposure scenario).

Groundwater Investigations

- Regional Groundwater Model Sampling - During Phase 1 of the Sauget Area 2 Supplemental Remedial Investigation, groundwater samples were collected from monitoring wells throughout the region, including monitoring wells at Sauget Area 2 sites, Sauget Area 1 sites, the W.G. Krummrich facility, and ConocoPhillips bulk storage terminal. In addition, groundwater samples were collected from 26 groundwater monitoring wells installed during Phase 2 of the Sauget Area 2 Supplemental Remedial Investigation. Groundwater quality data from these 2005/2006 sampling programs were used for calibration of the regional groundwater model (GSI, 2008b).
- Soil to Groundwater Leaching Investigation - Groundwater samples were collected in the SHU downgradient of the highest detected cadmium concentrations in Dead Creek Segments C, D, E, and F to determine if leaching from creek bottom soil to groundwater was a migration pathway (Golder Associates, 2007b).

Creek Bottom Soil Investigations

- Post Sediment-Removal Creek Bottom Soil Investigation- After completion of sediment removal in Dead Creek in 2001, creek bottom soil samples were collected in Creek Segments B, C, D, E, and F to characterize residual constituent concentrations and provide information for the Dead Creek Final Remedy HHRA (ENSR, 2001 and ENSR, 2002) and ERA (Menzie-Cura, 2002). In 2003, sediment samples were collected in Borrow Pit Lake upstream and downstream of the confluence of the channel portion of Creek Segment F (Solutia, 2008b).

- Post Soil-Removal Creek Bottom Soil Investigation - Creek bottom soils were removed in Creek Segments B (2005), Creek Segment D (2006), Creek Segment E (2006), Creek Segment F (2006), and the Borrow Pit Lake (2006) to achieve site-specific, risk-based concentrations for the protection of forage fish (i.e., small fish which serve as food for predatory fish and birds) or site-specific, soil to groundwater leaching criteria. Confirmatory samples were collected in all four creek segments and Borrow Pit Lake to demonstrate that criteria were achieved (Solutia, 2008b).

2.5.5 - Sources of Contamination

As indicated, pursuant to EPA's 2000 modified UAO for the Dead Creek Removal Action, the PRPs, with EPA oversight, excavated sediments from Dead Creek Segments B, C, D, E, F, and Site M. Later, in 2005-2006, pursuant to an amendment to the UAO, the PRPs excavated creek bottom soils exceeding target risk levels from Creek Segments B, D, and F and Borrow Pit Lake; and installed an armored impermeable liner throughout the entire length of Creek Segment B.

These removal actions have eliminated risks above EPA's acceptable levels for human health and the environment in the Dead Creek, Site M, and Borrow Pit Lake[10].

The RI concluded Site I North and Site N are not contaminant source areas. Site I North contains inert fill materials such as bricks, pieces of concrete, large concrete slabs, rebar, sheet metal, wood, fill soil, and gravel. Site N predominantly contains construction debris and some crushed drums. Neither area contains contamination in soils above levels of concern, e.g., containing levels which potentially threaten human health or the environment[11].

The remaining contaminant source areas at the Sauget Area 1 Site are the disposal areas at Sites G, H, I South, and L. These disposal areas contain municipal and industrial waste materials, including crushed or partially crushed drums, drum fragments, uncontained soil and liquid wastes, wood, glass, paper, construction debris, and miscellaneous trash.

The lower portion of waste at these sites is below the water table. In addition, there is residual DNAPL in the aquifer matrix underlying portions of Sites G, H, and I South. Residual DNAPL was not identified in the aquifer matrix underlying Site L. The dissolution of residual DNAPL in the MHU and DHU beneath Sites G, H, and I South is an on-going source of contamination to downgradient groundwater.

The potential for the source material at the Sauget Area 1 Sites to contaminate or migrate to groundwater is based on the leachability of the source material, the age of the source material, the relative amount of leaching that has already occurred, and the type of surface cover. The source material observed in the Sauget Area 1 Sites includes constituents that may be relatively leachable. Due to the nature of the waste materials present in Sites G, H, I South, and L, there is likely some contaminant migration from these fill areas into the underlying aquifer. However, as summarized in the Sauget Area 1 RI/FS, the results of mass flux calculations shows that the mass flux due to leaching of unsaturated source materials within the fill areas at Sites G, H, I South, and L is relatively small (1% for chlorobenzene and 1.5% for 1,4-dichlorobenzene) compared to the mass flux of contaminants from the saturated residual DNAPL source areas beneath Sites G, H, and I South due to groundwater flow (99% for chlorobenzene and 98.5% for 1,4-dichlorobenzene). To illustrate this, Figure 4 shows a cross-section of the contaminant mass flux conceptual site model.

These results indicate that interior leachate recovery would remove only a relatively small mass of constituents and therefore would not significantly reduce the time to meet remedial goals. In addition, the results also indicate that an impermeable cover's (RCRA Subtitle C covers) function of reducing the potential mobility of constituents in soil and waste by reducing infiltration of rainwater through the fill areas would not reduce the mass flux due to lateral groundwater flow in the underlying aquifer and will therefore have no significant effect on the time to restore groundwater quality downgradient of the Sauget Area 1 source areas. Installing

[10] Sauget Area 1 Dead Creek Final Remedy Creek Bottom Soil Human Health Risk Assessment (ENSR Corporation, April 2006)
[11] Sauget Area 1 – Human Health Risk Assessment, (ENSR International, June 2001)

impermeable covers at Sites G, H, and I South, with or without leachate control, would have no significant effect on time to achieve MCLs and Class I standards in groundwater downgradient of the Sauget Area 1 source areas. This finding is relevant to the detailed evaluation of Alternative 3, which includes RCRA Subtitle C covers, and also to the detailed evaluation of Alternative 4, which includes RCRA Subtitle C covers and leachate controls in Section 2.10.2.

The principal contaminants in groundwater are volatile organic compounds (VOCs) and semi-organic volatile compounds (SVOCs). As the plumes from Sauget Area 1 move toward the west, they combine with plumes originating from sources at other sites in the Sauget region, including the Sauget Area 2 Sites, Clayton Chemical, and the W.G. Krummrich facility. It is important to note that, based on results presented in the groundwater modeling report (GSI, 2008), the mass flux from the Sauget Area 1 sources to the Mississippi River is an extremely small fraction of the mass flux to the River as compared to the non-Sauget Area 1 sources (e.g., Sauget Area 2 and Krummrich[12]).

The plume from Site I South and the plume from Sites G, H, and L are intercepted by the Sauget Area 2 GMCS, located approximately 5,200 feet downgradient of the western boundary of the Sauget Area 1 sources. Mass flux of Site contaminants from the Sauget Area 1 source areas due to groundwater flow was estimated to be 2,780 kg/year based on a mass flux study. Based on fate and transport modeling, mass flux removed by the GMCS in 2006 from the Sauget Area 1 plumes was 142 kg/year, and mass flux to the Mississippi River in 2006 from the Sauget Area 1 plumes was 94 kg/year. Natural attenuation processes removed an estimated 2,554 kg/yr of Site constituents in 2006[13].

2.5.6 - Types of Contaminants and Affected Media

During the RI and SI, nine indicator constituents[14], which include six volatile organic compounds[15] (VOCs), two semi-volatile organic compounds[16] (SVOCs), and one herbicide were identified and sampled to define the nature and extent of contamination at the source areas and in groundwater. The six VOC indicator constituents are benzene, chlorobenzene, and a group of

[12] 2012 Update of the Regional Groundwater Flow and Transport Model shows Sauget Area 1 accounts for an estimated 1.4 percent of the mass flux to the River from Site constituents in 2006 with source areas from the Sauget Area 2 Sites, Krummrich Facility, and Clayton Chemical contributing to the remaining 98.6 percent of the mass flux of constituents to the River.

[13] Thus, due to natural attenuation, only 236 kg/year out of the total 2,780 kg/yr, or 8.5 percent ultimately has a chance to release to the River. Of this 236 kg/year total, 142 kg/yr, or 60 percent is captured and treated by the GMCS. Thus, in total, natural attenuation and the GMCS reduce the amount of mass flux to the River from Area 1 sources by 97 percent.

[14] An indicator constituent is a constituent selected from the group of constituents found at the site and used for a public health evaluation. They are selected on the basis of toxicity, mobility and persistence, and are thought to be the chemicals of the greatest potential risk.

[15] Volatile organic compounds or VOCs are organic chemical compounds whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure.

[16] A semi volatile organic compound is an organic compound which has a boiling point higher than water and which may vaporize when exposed to temperatures above room temperature.

four chlorinated ethenes, including tetrachloroethene, trichloroethene, 1,2-dichloroethene (1,2-DCE), and vinyl chloride. The two SVOC indicator constituents are 1,4-dichlorobenzene and 4-chloroaniline, and the herbicide indicator constituent is 2,4-dichlorophenoxyacetic acid (2,4-D). Benzene, chlorobenzene, 1,4-dichlorobenzene, 1,2-DCE, vinyl chloride, and 4-chloroaniline were selected as indicator constituents because of their presence at elevated concentrations in groundwater at and downgradient of the Sauget Area 1 sites. Tetrachloroethene and trichloroethene were not found to be widespread in groundwater but were selected as indicator constituents because they are parent compounds of 1,2-DCE and vinyl chloride and were detected in subsurface soil and waste. The herbicide 2,4-D is not widespread in groundwater but was selected as an indicator constituent because it was detected in groundwater samples from beneath the Site G and Site H source areas and in several groundwater samples downgradient of Site I South.

The detection of indicator constituents for Sites G, H, I South, and L are summarized below in Tables 1 through 4, respectively.

Table 1 – Site G: Maximum, Minimum and Mean Concentrations of Indicator Constituents in Subsurface Soil and Wastes

Indicator Constituents (mg/kg)		No. of Detects	Minimum Concentration	Mean Concentration	Maximum Concentration
VOCs	Benzene	6	0.003	15.3	45.3
	Chlorobenzene	8	0.107	108	538
	Tetrachloroethene	8	0.009	18.8	58.6
	Trichloroethylene	4	0.762	1.94	3.85
	cis-1,2-DCE	ND	ND	ND	ND
	Vinyl Chloride	ND	ND	ND	ND
SVOCs	1,4-Dichlorobenzene	2	2.38	2.97	3.56
	4-Chloroaniline	3	5.97	81.6	231
Herbicides	2,4-D	ND	ND	ND	ND

In addition to the nine indicator constituents, PCBs and dioxins were also sampled for during the RI. Soil and waste samples taken from the site fill areas show PCB concentrations ranging from 13- 4,430 parts per million (ppm) at Site G, 0.25 – 18, 000 ppm at Site H, 20- 343 ppm at I South, and 16- 500 ppm at Site L. For dioxins, surface soil samples taken from the sites show dioxin mean (0.003 parts per billion (ppb)) and maximum (0.0084 ppb) concentrations for Site G; mean (0.533 ppb) and maximum (1.29 ppb) concentrations for Site H; mean (3.34 ppb) and maximum (12.7 ppb) concentrations for Site I South; mean (0.360 ppb) and maximum (0.864 ppb) concentrations for Site L; and mean (0.098 ppb) and maximum (0.345 ppb) concentrations for Site N.

Table 2 – Site H: Maximum, Minimum and Mean Concentrations of Indicator Constituents in Subsurface Soil and Wastes					
Indicator Constituents (mg/kg)		**No. of Detects**	**Minimum Concentration**	**Mean Concentration**	**Maximum Concentration**
VOCs	Benzene	7	0.004	15.2	61.3
	Chlorobenzene	6	0.024	97.6	452
	Tetrachloroethene	1	5.65	5.65	5.65
	Trichloroethylene	1	0.01	0.01	0.01
	cis-1,2-DCE	ND	ND	ND	ND
	Vinyl Chloride	ND	ND	ND	ND
SVOCs	1,4-Dichlorobenzene	5	0.062	6,320	30,600
	4-Chloroaniline	ND	ND	ND	ND
Herbicides	2,4-D	ND	ND	ND	ND

Table 3 – Site I South: Maximum, Minimum and Mean Concentrations of Indicator Constituents in Subsurface Soil and Wastes					
Indicator Constituents (mg/kg)		**No. of Detects**	**Minimum Concentration**	**Mean Concentration**	**Maximum Concentration**
VOCs	Benzene	10	0.023	3.81	24.1
	Chlorobenzene	12	0.010	34.7	127
	Tetrachloroethene	5	0.612	2.57	5.27
	Trichloroethylene	2	0.648	2.23	3.81
	cis-1,2-DCE	ND	ND	ND	ND
	Vinyl Chloride	ND	ND	ND	ND
SVOCs	1,4-Dichlorobenzene	8	1.60	255	1,840
	4-Chloroaniline	1	43.2	43.2	43.2
Herbicides	2,4-D	ND	ND	ND	ND

Table 4 – Site L: Maximum, Minimum and Mean Concentrations of Indicator Constituents in Subsurface Soil and Wastes					
Indicator Constituents (mg/kg)		**No. of Detects**	**Minimum Concentration**	**Mean Concentration**	**Maximum Concentration**
VOCs	Benzene	5	0.004	2.01	5.70
	Chlorobenzene	8	0.012	1.25	5.30
	Tetrachloroethene	ND	ND	ND	ND

Table 4 – Site L: Maximum, Minimum and Mean Concentrations of Indicator Constituents in Subsurface Soil and Wastes					
Indicator Constituents (mg/kg)		No. of Detects	Minimum Concentration	Mean Concentration	Maximum Concentration
	Trichloroethylene	ND	ND	ND	ND
	cis-1,2-DCE	ND	ND	ND	ND
	Vinyl Chloride	ND	ND	ND	ND
SVOCs	1,4-Dichlorobenzene	9	0.018	23.4	100
	4-Chloroaniline	6	0.043	98.7	270
Herbicides	2,4-D	ND	ND	ND	ND

The RI and supplemental investigation sampling results were evaluated in the human health risk assessment. The risk assessment determined the contaminants of potential concern (COPCs) and identified which chemicals and affected media drive potential risk at the Site. These findings are summarized in Section 2.7.2 of this ROD and discussed in greater detail in the RI Report.

2.5.7 - Extent of Contamination

All sediments were removed from Dead Creek Segments B, C, D, E, and F and Site M in 2000-2002 and all sediments exceeding target risk levels were excavated from Borrow Pit Lake in 2005-2006. Creek-bottom soils with concentrations exceeding target risk levels were excavated from Creek Segments B, D, and F in 2005-2006, and an armored impermeable liner was installed throughout the entire length of Creek Segment B.

The following summarizes the extent of remaining contamination at the Site:

Disposal Area Waste Characterization

Disposal area waste characterization investigations completed during the RI included the performance of soil gas and magnetometer surveys, installation of test trenches and borings and collection of waste characterization samples. Waste materials encountered at Sites G, H, I South, and L consisted of municipal and industrial waste materials, including crushed or partially-crushed drums, drum fragments and remnants, uncontained solid and liquid wastes, wood, glass, paper, construction debris, and miscellaneous trash. The fill material encountered at Site I North included bricks, pieces of concrete, large concrete slabs, rebar, sheet metal, other metal scrap, and wood. The fill material encountered at Site N consisted primarily of construction debris such as soil, brick, concrete, metal, tires, and wood.

All four boundaries of Sites G, H, I South, L, and N identified by air photo analysis were confirmed by soil gas surveys (VOCs detected inside the boundaries but not outside) and by boundary trenching.

Soil and waste characterization results for each of the sites are summarized below:

Site G

- Surface Soil - Constituents detected in surface soil at Site G included 13 pesticides as well as PCBs, dioxins, and metals. There were no detections of VOCs, SVOCs, or herbicides. Summary statistics for Site G surface soil analytical data are discussed further in the RI/FS report. No indicator constituents were detected in surface soil at Site G.

- Subsurface Soil and Waste – Test trenching at Site G revealed the presence of crushed or partially crushed drums and drum fragments, some of which contained waste materials. One intact drum was found, which was over-packed and disposed of off-Site

  Constituents detected in subsurface soil and waste at Site G included 15 VOCs, 25 SVOCs, 1 pesticide, 1 herbicide, PCBs, and metals. The greatest concentrations in subsurface soils were detected at depths between 10 to 25 feet below ground surface (bgs). Detections of the indicator constituents are summarized in the Table 1.

Site H

- Surface Soil - Constituents detected in surface soil at Site H included 3 VOCs, 11 SVOCs, 9 pesticides, 2 herbicides, PCBs, dioxin, and metals. Summary statistics for Site H surface soil analytical data are discussed further in the RI/FS report. The only detected indicator constituent was tetrachloroethene.

- Subsurface Soil and Waste – Anomaly trenching in Site H revealed the presence of partial drums and drum fragments. Other materials encountered included brick, wood, plastic, and other refuse. Constituents detected in subsurface soil and waste at Site H included 13 VOCs, 32 SVOCs, 3 pesticides, PCBs, 18 metals, and total cyanide. Summary statistics for historical Site H subsurface soil and waste analytical data are discussed further in the RI/FS report. Detections of the indicator constituents are summarized in the Table 2.

  Based upon results of previous investigations (Ecology and Environment, 1998), contaminant concentrations were generally higher in the central and northern portions of the site compared to the southern portion. Highest concentrations were generally from samples collected from 10 to 25 feet bgs.

Site I South

- Surface Soil – Constituents detected in surface soil at Site I South included 23 SVOCs, 15 pesticides, 1 herbicide, PCBs, dioxin, and metals. Summary statistics for Site I South surface soil analytical data are discussed further in the RI/FS report. The detections of

indicator constituents included one detection of 1,4-dichlorobenzene and two detections of 4-chloroaniline.

- Subsurface Soil and Waste – Crushed or partially crushed drums and drum fragments, some containing waste materials, were found. Other uncontained solid wastes were encountered during trenching, including contents leaking out of broken drums. Black soil, bricks, wood, and metal scraps were also encountered in the trenches. Constituents detected in historical subsurface soil and waste samples at Site I South included 13 VOCs, 28 SVOCs, 3 pesticides, 1 herbicide, PCBs, metals, and total cyanide. Summary statistics for historical Site I South subsurface soil and waste analytical data are discussed further in the RI/FS report. Detections of the indicator constituents are summarized in Table 3.

  Waste material was noted in several borings in Site I South at depths below the water table and consisted of oily sand, clay, wood, and cinders mixed with refuse. Contamination was detected at depths extending to 38 feet bgs.

Site I North

- Surface Soil – No Sauget Area 1 indicator constituents were detected in surface soil at Site I North. Summary statistics for Site I North surface soil analytical data are discussed further in the RI/FS report.

- Subsurface Soil and Waste – Bricks, pieces of concrete, large concrete slabs, rebar, sheet metal, other metal scrap, and wood were found in the Site I North trench. No indicator constituents were detected in subsurface soils at Site I North.

Site L

- Surface Soil - No indicator constituents were detected in surface soil at Site L. Summary statistics for Site L surface soil analytical data are discussed further in the RI/FS report.

- Subsurface Soil and Waste –Trenching in Site L revealed the presence of crushed or partially crushed drums and drum fragments, some containing waste materials. Other uncontained solid wastes were encountered during trenching. Other materials encountered in Site L trenching include bricks, rags, small pieces of concrete, and various other refuse. A variety of fill materials were encountered in Site L borings, but no specific uncontained waste substances were described in the field notes and logs.

  Constituents detected in subsurface soil and waste at Site L included 10 VOCs, 35 SVOCs, 1 herbicide, PCBs, metals, and total cyanide. Summary statistics for historical Site L subsurface soil and waste analytical data are discussed further in the RI/FS report. Contaminants in Site L were generally detected at depths ranging from 5 to 15 feet bgs. Detections of the indicator constituents are summarized in the Table 4.

Site N

- Surface Soil - Constituents detected in surface soil at Site N included 13 SVOCs, 7 pesticides, 1 herbicide, PCBs, dioxin, and metals. Summary statistics for Site N surface soil analytical data are discussed further in the RI/FS report. No indicator constituents were detected in surface soil at Site N.

- Subsurface Soil and Waste – Site N is located on property formerly owned by the H. H. Hall Construction Company and was primarily used for disposal of construction debris. The construction waste materials encountered in Site N trenches included bricks, concrete debris, rebar, metal pipes and cables, sheet metal, railroad ties, scrap lumber, telephone poles, crushed and partially crushed drums and drum lids, plastic sheeting, rags, scrap tires, various other refuse, and fill soil. No indicator constituents or PCBs were detected in subsurface soils at Site N.

Principal Threat Waste Evaluation

During the RI, the PRPs, with EPA oversight, conducted a principal threat waste evaluation to determine whether principal threat wastes are located at the Site.

Principal threat wastes include, but are not limited to liquids (i.e., waste contained in drums, lagoons or tanks, free product (NAPLs) floating on or under groundwater containing contaminants of concern); mobile source material (i.e., surface soil or subsurface soil containing high concentrations of contaminants of concern that are (or are potentially) mobile due to wind entrainment, volatilization, surface runoff, or sub-surface transport); highly toxic source material (i.e., buried drummed non-liquid wastes, buried tanks containing non-liquid wastes, or soils containing significant concentrations of highly toxic materials). The following discusses the evaluations for principal threat waste liquids, mobile source material, and highly toxic source material at the Site.

Principal Threat Waste Evaluation – Liquids

Buried drums and drum fragments were encountered during source area investigations at Sites G, H, I South, L, and N. No drums or drum fragments were encountered during investigations at Site I North. No underground tanks were found during any of these investigations. None of the buried drums found during test trenching at Sites G, H, I South, L, and N contained liquids constituting principal threat waste. No large caches of drums were seen in historical aerial photos.

NAPL survey results from the monitoring wells indicate pooled DNAPL is not widespread at Sauget Area 1. However, at Site I South, the presence of pooled DNAPL was confirmed at bedrock well BR-I and an adjacent DNAPL piezometer, A1-19, which is located 10 feet from BR-I. DNAPL recovery has been performed at BR-I every other week as an interim remedial measure since October 2008. A cumulative volume of approximately 378 gallons of DNAPL was recovered from BR-I during the entire recovery period (November 2006 through May 2012).

At Site G, evidence of possible pooled DNAPL was noted during NAPL surveys at well BR-G, but three separate recovery tests showed no pooled DNAPL. There was no indication of pooled DNAPL in any of the wells or piezometers at Site H or Site L.

Principal Threat Waste Evaluation – Mobile Sources

Based on existing surface conditions at the Sauget Area 1 sites, there is no significant risk of wind entrainment, volatilization, or surface runoff of high concentrations of contaminants of concern from surface soil or subsurface soil.

DNAPL trapped by capillary forces in pore spaces of soil within the unsaturated zone or aquifer matrix (residual DNAPL) is not considered a mobile source material. Typically, the majority of DNAPL mass migrating from a source area is trapped by capillary forces within the alluvial aquifer pore space as residual DNAPL in small, discrete blobs and ganglia. Residual DNAPL is not expected to be mobile due to these capillary forces, but is expected to dissolve relatively slowly in groundwater. Therefore, with industrial disposal ceasing in 1957 at Sites H and I South and in 1966 at Site G, residual DNAPL at these sites is not likely to be mobile.

Although residual DNAPL is not itself a mobile source material, it is considered to be a significant source of on-going contamination to groundwater. The DNAPL characterization and remediation study estimated the total volume of fill and aquifer matrix at Sites G, H, and I South affected by residual DNAPL is approximately 1,200,000 cubic yards.

Principal Threat Waste Evaluation – Highly Toxic Source Materials

The PRPs, with EPA oversight, conducted a toxicity evaluation to identify whether waste materials and soils within Sites G, H, I North, I South, L, and N may be defined as principal threat wastes. Results of the evaluation were presented in the Disposal Area Waste Toxicity Evaluation (ENSR, 2008).

Disposal Area Waste Toxicity Evaluation – The data from the EE/CA and RI/FS waste characterization was evaluated in the HHRA (ENSR, 2001), and all potential risks from ingestion, dermal contact, and inhalation of surface soil were below a cancer risk of 10^{-3}, which indicated that these materials are not principal threat wastes. A review of dose-response factors was performed in 2008 as part of ENSR's evaluation to ensure that significant changes had not occurred which would elevate potential risks above 10^{-3}. The updated dose-response assessment did not result in potential risks above 10^{-3} (ENSR, 2008). The data from the DNAPL Characterization and Remediation Report (GSI, 2006c) and the data from the supplemental investigations (Tetra Tech, 2003a, b, c) were summarized and evaluated in the Disposal Area Waste Toxicity Evaluation (ENSR, 2008).

The evaluation concluded that total potential carcinogenic risk to construction worker was found to be 8.9×10^{-6} for the data from the DNAPL investigation and 1×10^{-4} for the data from the supplemental investigations. These values are below EPA's principal threat waste threshold of 1

x 10^{-3}. Therefore, no highly toxic source material principal threat waste was identified in waste material or soils within Sites G, H, I North, I South, L, and N.

Utility Corridor Evaluation – Site H at one time was connected to Site I South and together they were known to be part of the Sauget Monsanto Landfill, which operated from approximately 1931 to 1957. To evaluate risks to utility workers, a subsurface investigation was performed in the utility corridor along Queeny Avenue between Sites H and I South (Golder, 2008). The PRPs, with EPA oversight, conducted a toxicity evaluation of the data collected in the utility corridor investigation and identified potential risks greater than $1x10^{-3}$ in the utility corridor, south of Queeny Avenue, adjacent to Site H (ENSR, 2008). Constituents with risks above $1x10^{-3}$ include PCBs and dioxins. These wastes are therefore defined as principal threat wastes.

Summary of Extent of Contamination

The remaining contaminant source areas at Sauget Area 1 are the disposal areas at Sites G, H, I South, and L. There is residual DNAPL in the aquifer matrix underlying portions of Sites G, H, and I South, and the dissolution of residual DNAPL in the MHU and DHU beneath the Site G, H, and I South represents an on-going source of constituents to downgradient groundwater. Additionally, principal threat waste identified for the Site was determined to be the pooled DNAPL located on Site I South and in the highly toxic soils located in the utility corridor adjacent to Site H, south of Queeny Avenue.

2.6 – Current and Potential Future Site and Resource Uses

The Sauget Area 1 Site has been used for industrial purposes for many years (since the 1930's or earlier) and use of these areas is expected to remain industrial. The sites within Sauget Area 1 are zoned commercial/industrial and it is likely that the sites will continue to be used well into the reasonably foreseeable future for commercial/industrial purposes.

Historically, groundwater from the American Bottoms aquifer was a major source of water for the area and was used for industrial, public, and irrigation purposes. Groundwater levels prior to industrial and urban development was near land surface. Intensive industrial groundwater withdrawal and use and construction of a system of drainage ditches, levees, and canals to protect developed areas lowered the groundwater elevation for many years. However, by the mid-1980s, the groundwater levels increased due to reduced pumpage, high river stages, and high precipitation. Currently, no groundwater is being pumped from the American Bottoms aquifer in the vicinity of Sauget Area 1 for public, private, or industrial supply purposes. Groundwater is not a source of drinking water in the area. The Villages of Sauget and Cahokia have issued ordinances prohibiting the use of groundwater as a potable water source. These ordinances were issued in response to historic industrial use in the region, and resulting groundwater quality impairments. Groundwater use restrictions will likely remain in place for the foreseeable future due to the extent of the groundwater quality impairments.

2.7 - Summary of Site Risks

2.7.1 - Summary of Human Health Risk Assessment

A human health risk assessment (HHRA) estimates what risks a site poses to human health if no action is taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the HHRA for the Sauget Area 1 Site. Throughout the remedial investigation studies, various human health risk assessments (HHRA) have been conducted by the PRPs, with EPA oversight, for the Sauget Area 1 Site, including the Site-wide HHRA (2001); Dead Creek Bottom Soil HHRA (2006); Vapor Intrusion HHRA (2008); and Utility Corridor HHRA (2008). The PRPs completed these Site-specific risk assessments, as required by EPA's 1999 RI/FS AOC signed by the PRPs, for the purpose of quantifying the potential threat to public health from actual or threatened releases of hazardous substances into the environment. The HHRAs were prepared using EPA's Risk Assessment Guidance for Superfund (RAGS) and evaluated potential current and future exposure scenarios at the Site.

The objectives of the risk evaluation using the HHRA were the following: (1) to investigate whether Site-related constituents detected in environmental media pose risks above EPA acceptable levels for current and future human receptors, and (2) to provide information to support decisions concerning the need for further evaluation or action, based upon current and reasonably anticipated future land use. For the purposes of the risk assessment, future land uses were assumed to be the same as current land uses. Current land uses are commercial/industrial. Receptors were identified for the sites based on the CSM for human health and the COPCs identified in media in the areas. The potential receptor groups considered included:

- Sites (G, H, I South, L and N)
  - Future indoor industrial workers
  - Future outdoor industrial workers
  - Future construction/utility workers
  - Future trespassing teenagers
  - Future residents (Site N only)
- Transect Areas
  - Future outdoor industrial workers
  - Future construction workers
  - Future residents
- Dead Creek, Borrow Pit Lake, and Site M
  - Future construction/utility workers
  - Current and future recreational child/teen
  - Current and future recreational anglers

Two general types of health risk were characterized for each potential exposure pathway considered: Potential carcinogenic risk (risk) and potential non-carcinogenic hazard (hazard). Risks and hazards were calculated using standard risk assessment methodologies. Risks were

compared to EPA's acceptable risk range: from $1x10^{-6}$ (one cancer per one million exposed receptors) to $1x10^{-4}$ (one cancer per ten thousand exposed receptors). Risks less than $1x10^{-6}$ are considered insignificant. Risks within the above range are remediated at the discretion of EPA risk managers. Risks greater than $1x10^{-4}$ typically require remediation. Non-carcinogenic hazards are compared to a target hazard index (HI) of 1. The potential risks from the individual contaminants and exposure pathways are added up to calculate total Site risk.

As noted above, as part of the remedial investigation for the Site various HHRAs were prepared. The following provides a brief description of the various human health risk assessments conducted in the Sauget Area 1 Site:

- **Site-Wide HHRA**: PRPs conducted a Site-wide HHRA for the Sauget Area 1 Sites (G, H, I North, I South, L, and N) and seven Transect Areas in 2001. Site M was not included in the Site-wide HHRA because it was subject to remediation and assessed in the Dead Creek Bottom Soils HHRA and no longer posed unacceptable risk to human health or the environment. The Site-wide HHRA also evaluated portions of Dead Creek Segment F not subject to remediation and Borrow Pit Lake.

- **Vapor Intrusion HHRA**: The Site-wide HHRA (2001) included an evaluation of potential risks to an indoor worker based on volatilization of constituents in groundwater to indoor air of an overlying hypothetical building. Due to the evolving science of vapor intrusion, the vapor intrusion evaluation was updated in 2009 in the Vapor Intrusion HHRA (VI HHRA, AECOM, 2009).

- **Dead Creek Bottom Soils HHRA**: The Dead Creek Bottom Soils HHRA assessed the creek bottom soils in Dead Creek segments following the removal of sediments from Dead Creek Segments B, C, D, E, a portion of Creek Segment F, and Site M. Confirmation samples were collected and evaluated in the Dead Creek Bottom Soils HHRA (2006).

- **Utility Corridor HHRA**: An investigation of subsurface soil in areas along the existing utility lines that are in or adjacent to Sites H and I was conducted in 2007-2008.

To guide identification of appropriate exposure pathways for evaluation in the risk assessments, the PRPs, with EPA oversight, developed a CSM for human health (Figure 2) to identify source areas, potential migration pathways of contaminants from source areas to environmental media where exposure can occur, and to identify potential human receptors. The CSM for human health was discussed in Section 2.5.1.

The CSM links contaminant concentrations in various media to potential human exposure. The CSM identified the following exposure scenarios for each site:

- Sites (G, H, I South, L, and N)
  - Future indoor industrial workers were assumed to be exposed indirectly to groundwater through inhalation of volatile COPCs migrating from groundwater and the subsurface to indoor air of an industrial/commercial building.

  - Future outdoor industrial workers were assumed to be exposed to COPCs in surface soil through incidental ingestion and dermal contact and inhalation of particulates in ambient air.
  - Future construction/ utility workers were assumed to be exposed to COPCs through incidental ingestion of and dermal contact with soil/waste and shallow groundwater and through inhalation of fugitive dust and/or vapors from soil and groundwater.
  - Future trespassing teenagers were assumed to be exposed to COPCs in surface soil in the fill areas through accidental ingestion, dermal contact, and inhalation of volatiles and particulates.
  - Future residents (Site N only) were assumed to be exposed directly to COPCs in soil through incidental ingestion, dermal contact, and inhalation of volatiles and particulates. Indirect exposure was assumed through the ingestion of produce grown in impacted residential soil.
- Transect Areas
  - Future outdoor industrial workers were assumed to be exposed to COPCs through incidental ingestion of and dermal contact with soil/waste and through inhalation of fugitive dust from soils.
  - Future construction workers were assumed to be exposed to COPCs through incidental ingestion of and dermal contact with soil/waste and shallow groundwater and through inhalation of fugitive dust and/or vapors from soil and groundwater.
  - Future residents were assumed to be exposed directly to COPCs in soil through incidental ingestion, dermal contact, and inhalation of volatiles and particulates. Indirect exposure was assumed through the ingestion of produce grown in impacted residential soil.
- Dead Creek, Borrow Pit Lake, and Site M
  - Future construction/utility workers could be exposed to COPCs in creek bottom soil of Site M and Creek Segment B through Creek Segment F during excavation as underground utility lines are present in several of the Creek Segments.
  - Current and future recreational child/teen could be exposed to COPCs present in surface water and sediments of Dead Creek and Borrow Pit Lake while wading or swimming, respectively and by accidental ingestion.
  - Current and future recreational anglers (Borrow Pit Lake only) were assumed to be exposed to site-related COPCs through ingestion of fish from Borrow Pit Lake.

Assumptions about exposure frequency, duration, and other exposure factors are discussed in more detail in the HHRAs.

2.7.2 - Data Quality and Usability

Data were evaluated based on completeness, holding times, initial and continuing calibrations, surrogate recoveries, internal standards, compound identification, laboratory and field quality assurance/quality control (QA/QC) procedures and results, reporting limits, documentation practices, and application of validation qualifiers. Analytical data collected during the RI and SI were considered to be acceptable for use in the HHRAs.

2.7.3 - Identification of Contaminants of Concern

For potentially carcinogenic risk results, COCs are identified as those COPCs that cause an exceedance of the target risk level of $1x10^{-4}$. For noncarcinogenic hazard results, COCs are identified as those COPCs that cause an exceedance of the toxic-endpoint specific HI of 1.

Tables 5, 6, 7, 8, and 9 present the contaminants of concern (COCs) that pose potential threats to human health in the specified mediums for Sites G, H, I South, L, and N. The tables also identify the exposure point concentrations (EPCs), the concentration ranges, the detection frequency, and how the EPCs were derived. An EPC is an estimate of the true arithmetic mean concentration of a chemical in a medium at an exposure point and is discussed in Section 2.7.5.

2.7.4 - Exposure Assessment

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPCs retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and the surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios identifying appropriate environmental media and exposure pathways for current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPCs are identified and are judged to be complete are evaluated quantitatively in the risk assessment. The exposure pathways and receptors considered for evaluation at the Sauget Area 1 Site, along with the rationale for their inclusion in, or exclusion from, the quantitative risk assessment are described in the HHRAs.

Sauget Area 1 Sites (G, H, I South, L, and N) have been used for industrial purposes for many years and use of these areas is expected to remain industrial. Therefore, the sites were evaluated for commercial/industrial use scenarios in the Site-wide HHRA (ENSR, 2001). However, Site N was evaluated for both a commercial/industrial, as well as a hypothetical future residential scenario, to determine whether or not potential risks remained at the Site under the residential use scenario. This was done because if the investigation found no potential risks under a potential residential use scenario, the Site could be determined to have unlimited uses and unrestricted exposures.

2.7.5 - Exposure Point Concentrations

Exposure points are located where potential receptors may contact COCs at or from the Site. The concentration of COCs in the environmental medium that receptors may contact must be estimated in order to determine the magnitude of potential exposure. Both measured and modeled EPCs scenarios were developed. The approaches used to calculate EPCs under the two scenarios are presented in the HHRA. EPCs were calculated following the methods and recommendations provided in EPA's risk assessment guidance.

A summary of the EPCs for the sites is provided above in Tables 5, 6, 7, 8, and 9.

Table 5 – Summary of Contaminants of Concern for Site G

Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Subsurface Soil (Ing/Derm)	Phosphorus	1.83E+02	1.34E+03	NA	8.98E+02	95% UCL
	Total PCBs	1.30E-01	4.43E+03	NA	4.43E+03	Max
Groundwater (Inhalation)	Well EE-05					
	Benzene	2.98E-03	2.98E-03	1/1	2.98E-03	Max
	Naphthalene	8.51E-03	8.51E-03	1/1	8.51E-03	Max
	Well EEG-107					
	Benzene	1.00E-01	1.00E-01	1/1	1.00E-01	Max
	Naphthalene	4.58E-02	4.58E-02	1/1	4.58E-02	Max
Leachate (Inhalation)	Benzene	8.80E-01	8.80E-01	1/1	8.80E-01	Max
	Chlorobenzene	2.80E+00	2.80E+00	1/1	2.80E+00	Max
	Naphthalene	1.00E+00	1.00E+00	1/1	1.00E+00	Max

(1) Soil (Ingestion/Dermal) units – mg/kg
Groundwater (Inh) units – mg/m^3
Leachate (Inh) units – mg/L

COC – Contaminant of Concern
Max – Maximum Detected Concentration
NA – Not available
PCB - Polychlorinated Biphenyls
95% UCL – 95% Upper Confidence Limit

Table 6 – Summary of Contaminants of Concern for Site H

Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Soil/Waste – (Ing/Derm)	2,3,7,8-TCDD TEQ	1.51E-03	4.00E-01	8/9	4.00E-01	Max
	4,4-DDD	7.90E-01	9.40E+02	6/9	9.40E+02	Max
	4,4-DDT	2.70E+00	7.60E+02	7/9	7.60E+02	Max
	Dieldrin	6.60E-03	8.90E+01	7/9	8.90E+01	Max
	Total PCBs	2.62E+01	8.58E+03	6/9	8.58E+03	Max
Soil/Waste (Inhalation)	2,3,7,8-TCDD TEQ	1.50E-03	4.00E-01	8/9	4.00E-01	Max
	4,4-DDT	2.70E+00	7.60E+02	7/9	7.60E+02	Max
	Barium	1.50E+02	8.20E+04	9/9	8.20E+04	Max
	Chlorobenzene	1.60E-01	6.80E+03	9/9	6.80E+03	Max
	Dieldrin	6.60E-03	8.90E+01	7/9	8.90E+01	Max
	Total PCBs	2.62E+1	8.58E+03	6/9	8.58E+03	Max
Subsurface Soil (Ing/Derm)	Total PCBs	2.51E-01	1.80E+04	NA	1.80E+04	Max
Subsurface Soil (Inhalation)	Manganese	7.00E+00	3.65E+04	NA	3.65E+04	Max

Table 6 – Summary of Contaminants of Concern for Site H

Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Groundwater (Inhalation)	Well EE-01					
	Benzene	4.06E-02	4.06E-02	1/1	4.06E-02	Max
	Chloroform	--	--	--	--	--
	Well EE-02					
	Benzene	6.09E-02	6.09E-02	1/1	6.09E-02	Max
	Chloroform	1.16E-02	1.16E-02	1/1	1.16E-02	Max
Leachate (Ing/Derm)	Cadmium	1.30E-01	2.20E+01	3/5	2.20E+01	Max
Leachate (Inhalation)	Benzene	8.70E-02	2.5E+00	2/5	2.5E+00	Max

(1) Soil/Waste (Ingestion/Dermal) units – mg/kg
Soil/Waste (Inh) units – mg/kg
Groundwater (Inh) units – mg/m^3
Leachate (Ingestion/Dermal) units – mg/L
Leachate (Inh) units – mg/L

COC – Contaminant of Concern
Max – Maximum Detected Concentration
NA – Not available
PCB – Polychlorinated Biphenyls
2,3,7,8-TCDD TEQ – 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent

Table 7 – Summary of Contaminants of Concern for Site I South

Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Surface Soil (Ing/Derm)	2,3,7,8-TCDD TEQ	7.23E-05	1.27E-02	4/4	1.27E-02	Max
	Total PCBs	6.10E-02	1.21E+02	3/4	1.21E+02	Max
Subsurface Soil (Ing/Derm)	Antimony	1.4E+01	6.66E+03	NA	6.66E+03	Max
	Total PCBs	2.04E+01	3.43E+02	NA	3.43E+02	Max
Leachate (Ing/Derm)	MCPP	3.40E+01	3.40E+01	1/1	3.40E+01	Max
	Total PCBs	1.08E-01	1.08E-01	1/1	1.08E-01	Max
Leachate (Inhalation)	Chlorobenzene	9.5E-01	9.5E-01	1/1	9.5E-01	Max
	Chloroform	2.60E-02	2.60E-02	1/1	2.60E-02	Max
	Naphthalene	2.50E+00	2.50E+00	1/1	2.50E+00	Max

(1) Soil (Ingestion/Dermal) units – mg/kg
Soil (Inh) units – mg/kg
Leachate (Ingestion/Dermal) units – mg/L
Leachate (Inh) units – mg/L

COC – Contaminant of Concern
Max – Maximum Detected Concentration
MCPP - 2-(2-Methyl-4-chlorophenoxy) propionic acid
NA – Not available
PCB – Polychlorinated Biphenyls
2,3,7,8-TCDD TEQ – 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent

Table 8 – Summary of Contaminants of Concern for Site L

Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Subsurface	Total PCBs	1.60E+01	5.00E+02	NA	5.00E+02	Max

Table 8 – Summary of Contaminants of Concern for Site L						
Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Soil (Ing/Derm)						
(1) Soil (Ingestion/Dermal) units – mg/kg				COC – Contaminant of Concern Max – Maximum Detected Concentration NA – Not available PCB – Polychlorinated Biphenyls		

Table 9 – Summary of Contaminants of Concern for Site N						
Exposure Point	COC	Concentration Detected (1)		Frequency of Detection	Exposure Point Concentration	Statistical Measure
		Min	Max			
Surface Soil – (Ing/Derm)	2,3,7,8-TCDD TEQ	NA	3.45E-04	4/4	3.45E-04	Max
(1) Soil (Ingestion/Dermal) units – mg/kg				COC – Contaminant of Concern Max – Maximum Detected Concentration 2,3,7,8-TCDD TEQ – 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent; NA – Not available		

2.7.6 - Toxicity Assessment

The toxicity assessment provides a description of the relationship between a dose of a chemical and the potential likelihood of an adverse health effect. The purpose of the toxicity assessment is to provide a quantitative estimate of the inherent toxicity of COCs for use in risk characterization. Potential health risks for COCs are evaluated for both carcinogenic and non-carcinogenic risks.

The purpose of the toxicity assessment is to assign toxicity values (criteria) to each contaminant evaluated in the risk assessment. The toxicity values are used in conjunction with the estimated doses to which a human could be exposed to evaluate the potential human health risk associated with each contaminant. In evaluating potential health risks, both carcinogenic and non-carcinogenic health effects were considered.

Cancer slope factors (CSFs) are developed by the EPA under the assumption that the risk of cancer from a given chemical is linearly related to dose. CSFs are developed from laboratory animal studies or human epidemiology studies and classified according to route of administration. The CSF is expressed as $(mg/kg/day)^{-1}$ and when multiplied by the lifetime average daily dose expressed as mg/kg/day will provide an estimate of the probability that the dose will cause cancer during the lifetime of the exposed individual. Cancer toxicity data for the COCs are summarized in Tables 10 and 12, below.

Table 10 – Cancer Toxicity Data Summary
Sites G, H*, I South, L, N

Pathway: Ingestion, Dermal

Contaminant of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
MCPP	NA	NA	NA	NA	NA	NA
Total PCBs	2.0E+00	NA	NA	B2	IRIS	Nov-2000
2,3,7,8-TCDD TEQ	1.5E+05	NA	NA	B2	HEAST	Jul-1997
Antimony	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	B1	IRIS	Nov-2000
Phosphorous	NA	NA	NA	NA	NA	NA

Pathway: Inhalation

Contaminant of Concern	Unit Risk	Units	Inhalation Cancer Slope factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Benzene	2.2E-06	$(\mu g/m^3)^{-1}$	7.7E-03	$(mg/kg\text{-}day)^{-1}$	A	IRIS	Nov-2000
Chlorobenzene	NA	NA	NA	NA	D	IRIS	Nov-2000
Chloroform	2.3E-05	$(\mu g/m^3)^{-1}$	8.05E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Nov-2000
Naphthalene	NA	NA	NA	NA	C	IRIS	Nov-2000
Manganese	NA	NA	NA	NA	D	IRIS	Mar-2001

Notes:
COC: Contaminant of concern
NA: Not available
IRIS: Integrated Risk Information System, EPA
*Toxicity values used in the assessment of the Site H Construction Worker.
PCB: Polychlorinated Biphenyls
2,3,7,8-TCDD TEQ: 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent

A - Known Human Carcinogen
B1- Probable human carcinogen - indicates that limited human data are available
B2- Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C- Possible human carcinogen
D- Not classifiable as a human carcinogen
E- Evidence of non-carcinogenicity

This table provides carcinogenic risk information which is relevant to the contaminants of concern in soil, groundwater, and leachate. An adjustment factor is sometimes applied to the oral cancer slope factor to calculate the dermal cancer slope factor and is dependent upon the degree to which the chemical is absorbed via the oral route.

Table 11 – Non-Cancer Toxicity Data Summary
Sites G, H* I South, L, N

Pathway: Ingestion, Dermal

Contaminant of Concern	Chronic/ Subchronic	Oral RfD value1	Oral RfD Units	Dermal RfD Value	Dermal RfD Units	Primary Target Organ	Combined UF/MF	Sources of RfD Target Organ	Date
MCPP	Chronic	1.00E-03	mg/kg-day	NA	NA	Kidney	3000/1	IRIS	May-2001
Total PCBs(1)	Chronic	2.00E-05	mg/kg-day	NA	NA	Eyes, Immune, Phalanges	300/1	IRIS	Nov-2000
2,3,7,8-TCDD TEQ (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD TEQ (3)	Chronic	7.00E-10	mg/kg-day	7.00E-10	mg/kg-day	Testes	30	IRIS	Feb-2012
Antimony	Chronic	4.00E-04	mg/kg-day	NA	NA	Longevity, Blood	1000/1	IRIS	Nov-2000
Cadmium	Chronic	5.00E-04	mg/kg-day	NA	NA	Kidney	10/1	IRIS	Nov-2000
Phosphorous	Chronic	2.00E-05	mg/kg-day	NA	NA	Mortality, Hair	1000/1	IRIS	Mar-2001

Pathway: Inhalation

Contaminant of Concern	Chronic/ Subchronic	Inhalation RfC value	Inhalation RfC Units	Inhalation RfD Value	Inhalation RfD Units	Primary Target Organ	Combined UF/MF	Sources of RfC Target Organ	Date
Benzene	Chronic	6.00E-03	mg/m^3	1.70E-03	mg/kg-day	Blood	1000	NCEA	Jul-1996
Chlorobenzene	Chronic	2.00E-02	mg/m^3	5.71E-03	mg/kg-day	Liver and Kidney	10000/1	HEAST	Jul-1997
Chloroform	Chronic	NA	NA	8.6E-05	mg/kg-day	Nasal	NA	NCEA	Dec/1997
Naphthalene	Chronic	3.00E-03	mg/m^3	8.57E-04	mg/kg-day	Nasal	3000/1	IRIS	Nov-2000
Manganese	Chronic	5.00E-05	mg/m^3	1.43E-05	mg/kg-day	Neurological	1000/1	IRIS	Mar-2001

Notes:
*Toxicity values used in the assessment of the Site H Construction Worker.
(1) Value for Aroclor 1254 used as a surrogate for total PCBs.
(2) Used in the 2001 assessment of Site-I.
(3) Used in the 2012 assessment of Site-N.

PCB: Polychlorinated Biphenyls
2,3,7,8-TCDD TEQ: 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent
COC: Contaminant of concern; NA: Value not available/not calculated, UF/MF: Uncertainty factor/modifying factor
IRIS: Integrated Risk Information System
HEAST: Health Effects Assessment Summary Table
NCEA: National Center for Environmental Assessment

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil, groundwater, and leachate. An adjustment factor is sometimes applied, and is dependent upon the degree to which the chemical is absorbed vial the oral route.

Table 12 – Cancer Toxicity Data Summary for Utility Corridor Adjacent to Site H*

Pathway: Ingestion, Dermal

Contaminant of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
2,3,7,8-TCDD TEQ	1.5E+05	1.5E+05	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	Jul-1997
Total PCBs	2E+00	2E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Feb-2008
4,4-DDD	2.4E-01	2.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Feb-2008
4,4-DDT	3.4E-01	3.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Feb-2008
Dieldrin	1.6E+01	1.6E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Feb-2008

Pathway: Inhalation

Contaminant of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Barium	NA	NA	NA	NA	D	NA	NA
Chlorobenzene	NA	NA	NA	NA	D	NA	NA
2,3,7,8-TCDD TEQ	3.3E-05	$(\mu g/m^3)^{-1}$	1.5E+05	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	Jul-1997
Total PCBs	NA	NA	2E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Jan-2008
4,4-DDT	9.7E-05	$(\mu g/m^3)^{-1}$	3.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Jan-2008
Dieldrin	4.6E-03	$(\mu g/m^3)^{-1}$	1.61E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	Jan-2008

Notes:
COC: Contaminant of concern
NA: Not available
IRIS: Integrated Risk Information System, EPA
HEAST: Health Effects Assessment Summary Table
PCB: Polychlorinated Biphenyls
2,3,7,8-TCDD TEQ: 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent
*Toxicity values used in the assessment of the Site H Utility Worker.

A – Known Human Carcinogen
B1- Probable human carcinogen – indicates that limited human data are available
B2- Probable human carcinogen – indicates sufficient evidence in animals and inadequate or no evidence in humans
C- Possible human carcinogen
D- Not classifiable as a human carcinogen
E- Evidence of non-carcinogenicity

This table provides carcinogenic risk information which is relevant to the contaminants of concern in soil/waste. An adjustment factor is sometimes applied, and is dependent upon the degree to which the chemical is absorbed via the oral route.

Table 13 –Non-Cancer Toxicity Data Summary for Utility Corridor Adjacent to Site H*

Pathway: Ingestion, Dermal

Contaminant of Concern	Chronic/ Subchronic	Oral RfD value	Oral RfD Units	Dermal RfD Value	Dermal RfD Units	Primary Target Organ	Combined UF/MF	Sources of RfD Target Organ	Date
2,3,7,8-TCDD TEQ	Chronic	1E-09	mg/kg-day	1E-09	mg/kg-day	Developmental	NA	ATSDR	Nov-2007
Total PCBs	Chronic	2E-05 (1)	mg/kg-day	2E-05 (1)	mg/kg-day	Immune system	300/1	IRIS	Feb-2008
4,4-DDD	Chronic	5E-04 (2)	mg/kg-day	5E-04 (2)	mg/kg-day	Liver	100/1	IRIS	Feb-2008
4,4-DDT	Chronic	5E-04	mg/kg-day	5E-04	mg/kg-day	Liver	100/1	IRIS	Feb-2008
Dieldrin	Chronic	5E-05	mg/kg-day	5E-05	mg/kg-day	Liver	100/1	IRIS	Feb-2008

Pathway: Inhalation

Contaminant of Concern	Chronic/ Subchronic	Inhalation RfC value	Inhalation RfC Units	Inhalation RfD Value	Inhalation RfD Units	Primary Target Organ	Combined UF/MF	Sources of RfC Target Organ	Date
Barium	Chronic	5E-04	mg/m^3	1.4E-04	mg/kg-day	Fetus	1000/1	HEAST	Jul-1997
Chlorobenzene	Chronic	5E-02	mg/m^3	1.4E-02	mg/kg-day	Liver and Kidney	1000/1	PPRTV	Oct-2006
2,3,7,8-TCDD TEQ	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCBs	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
*Toxicity values used in the assessment of the Site-H Utility Worker.
(1) Value for Aroclor 1254 used as a surrogate for total PCBs.
(2) Value for 4,4-DDT used as a surrogate for 4,4-DDD.

COC: Contaminant of concern
NA: Value not available/not calculated
IRIS: Integrated Risk Information System
PPRTV: Provisional Peer Reviewed Toxicity Values
ATSDR: Agency for Toxic Substances and Disease Registry
HEAST: Health Effects Assessment Summary Table
PCB: Polychlorinated Biphenyls
2,3,7,8-TCDD TEQ: 2,3,7,8 Tetrachlorodibenzo-p-dioxin toxic equivalent
UF/MF = Uncertainty factor/modifying factor (EPA-IRIS, 2010)

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil, groundwater, and leachate. An adjustment factor is sometimes applied, and is dependent upon the degree to which the chemical is absorbed vial the oral route.

The toxicity criteria used to evaluate potential non-carcinogenic health effects are reference doses (RfDs). The RfD is expressed as mg/kg/day and represents that dose that has been determined by experimental animal tests or by human observation to not cause adverse health effects, even if the dose is continued for a lifetime. The procedure used to estimate this dose incorporates safety or uncertainty factors that assume it will not over-estimate this safe dose. Non-cancer toxicity data for the COCs are summarized in Tables 11 and 13, above.

2.7.7 - Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times SF$$

Where:

risk = a unitless probability (e.g., $2x10^{-5}$) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are expressed typically in scientific notation (e.g., $1x10^{-6}$). An excess lifetime risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure (RME) estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as excess lifetime cancer risk because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally-acceptable risk range for site-related exposures is $1x10^{-4}$ to $1x10^{-6}$.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any adverse effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs to which a given individual may reasonably be exposed that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media. An HI of 1 or less indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

Where:

CDI = chronic daily intake

RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Tables 14, 16, 18, 20, 22, and 24 summarize the potential carcinogenic risks and Tables 15, 17, 19, 21, 23, 25, and 26 summarize the potential non-carcinogenic risks from each site.

Table 14 –Risk Characterization Summary for Construction Workers Carcinogens - Site G

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Trench Air	Trench Air	Benzene	NA	1.78E-07	NA	1.78E-07
			Naphthalene	NA	--	NA	--
						Groundwater Risk Total	1.78E-07
Leachate	Air	Air	Benzene	NA	8.21E-08	NA	8.21E-08
			Chlorobenzene	NA	--	NA	--
			Naphthalene	NA	--	NA	--
						Leachate Risk Total	8.21E-08
Subsurface Soil	Subsurface Soil	Subsurface Soil	Phosphorous	--	NA	--	--
			Total PCBs	2.15E-05	NA	(1)	2.15E-05
						Subsurface Soil Risk Total	2.15E-05
						Risk total =	2.18E-05

-- Not calculated, no toxicity values available; NA – Not applicable; (1) Risks for incidental ingestion and dermal contact were presented as one total

Table 15 – Risk Characterization Summary for Construction Worker Non-Carcinogens - Site G

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk (Hazard Index)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Trench Air	Trench Air	Benzene	Developmental	NA	9.50E-01	NA	9.50E-01
			Naphthalene	Liver	NA	9.93E-01	NA	9.93E-01
							Groundwater Hazard Index	1.94E+00
Leachate	Air	Air	Benzene	Developmental	NA	4.39E-01	NA	4.39E-01
			Chlorobenzene	Liver and Kidney	NA	3.83E-01	NA	3.83E-01
			Naphthalene	Liver	NA	7.98E-01	NA	7.98E-01
							Leachate Hazard Index	1.62E+00
Subsurface Soil	Subsurface Soil	Subsurface Soil	Phosphorous	Mortality, Hair	7.07E+00	NA	(1)	7.07E+00
			Total PCBs	Eyes, Immune, Phalanges	3.76E+01	NA	(1)	3.76E+01
							Subsurface Soil Hazard Index	4.47E+01
							Hazard Index Total =	4.82E+01
							Developmental Hazard Index =	1.39E+00
							Liver Hazard Index =	2.17E+00
							Immune Hazard Index =	3.76E+01
							Kidney Hazard Index =	3.83E-01
							Hair Hazard Index =	7.07E+00
							Phalanges Hazard Index =	3.76E+01
							Eyes Hazard Index =	3.76E+01
							Mortality Hazard Index =	7.07E+00

NA – Not applicable
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 16 – Risk Characterization Summary for Utility Workers Carcinogens - Site H

Scenario Timeframe: Future
Receptor Population: Utility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk (1)			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil/Waste	Soil/Waste	Soil/Waste	2,3,7,8-TCDD TEQ	9E-03	4E-05	(2)	9E-03
			4,4-DDD	5E-05	NA	(2)	5E-05
			4,4-DDT	6E-05	2E-07	(2)	6E-05
			Dieldrin	5E-04	1E-06	(2)	5E-04
			Total PCBs	7E-03	1E-05	(2)	7E-03
			Barium	--	NA	--	--
			Chlorobenzene	--	NA	--	--
						Soil/Waste Risk Total	2E-02
						Risk total =	2E-02

-- – Not calculated, no toxicity values available
NA – Not applicable
(1) Risk estimates were presented to one significant digit in the Sauget Area 1 Utility Corridor Evaluation Human Health Risk Assessment (ESNR, 2008).
(2) Risks for incidental ingestion and dermal contact were presented as one total.

Table 17 – Risk Characterization Summary for Utility Worker Non-Carcinogens - Site H

Scenario Timeframe: Future
Receptor Population: Utility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk (Hazard Index)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil/Waste	Soil/Waste	Soil/Waste	2,3,7,8-TCDD TEQ	Developmental	1.6E+02	NA	(1)	1.6E+02
			4,4-DDD	Liver	1.2E+00	NA	(1)	1.2E+00
			4,4-DDT	Liver	1.0E+00	NA	(1)	1.0E+00
			Dieldrin	Liver	1.7E+00	NA	(1)	1.7E+00
			Total PCBs	Immune	4.6E+02	NA	(1)	4.6E+02
			Barium	Kidney	2.4E-01	1.1E+00	(1)	1.3E+00
			Chlorobenzene	Liver, Kidney	1.8E-01	1.8E+00	(1)	1.9E+00
							Soil Hazard Index Total =	6.8E+02
							Hazard Index Total =	6.8E+02
							Developmental Hazard Index =	1.6E+02
							Liver Hazard Index =	5.8E+00
							Immune Hazard Index =	4.60E+02
							Kidney Hazard Index =	1.9E+00

-- – Not calculated, no toxicity values available
NA – Not applicable
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 18 – Risk Characterization Summary for Construction Workers Carcinogens - Site H

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Trench Air	Trench Air	Benzene	NA	1.75E-07	NA	1.75E-07
			Chloroform	NA	1.38E-07	NA	1.38E-07
						Groundwater Risk Total	3.13E-07
Leachate	Leachate	Leachate	Cadmium	--	NA	--	--
Leachate	Air	Air	Benzene	NA	2.33E-07	NA	2.33E-07
						Leachate Risk Total	2.33E-07
Subsurface Soil	Subsurface Soil	Subsurface Soil	Total PCBs	8.73E-05	NA	(1)	8.73E-05
Subsurface Soil	Air (Particulates)	Air (Particulates)	Manganese	NA	--	NA	--
						Subsurface Soil Risk Total	8.73E-05
						Risk total =	8.78E-05

-- – Not calculated, no toxicity values available.
NA – Not applicable.
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 19 – Risk Characterization Summary for Construction Worker Non-Carcinogens - Site H

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk (Hazard Index)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Trench Air	Trench Air	Benzene	Liver	NA	9.35E-01	NA	9.35E-01
			Chloroform	Nasal	NA	2.12E+00	NA	2.12E+00
							Groundwater Hazard Index	3.06E+00
Leachate	Leachate	Leachate	Cadmium	Kidney	2.39E+00	NA	(1)	2.39E+00
Leachate	Air	Air	Benzene	Blood	NA	1.25E+00	NA	1.25E+00
							Leachate Hazard Index	3.64E+00
Subsurface Soil	Subsurface Soil	Subsurface Soil	Total PCBs	Eyes, Immune, Phalanges	1.53E+02	NA	(1)	1.53E+02
Subsurface Soil	Air (Particulates)	Air (Particulates)	Manganese	Neurological	NA	4.81E+00	NA	4.81E+00
							Subsurface Soil Hazard Index	1.58E+02
							Hazard Index Total =	1.64E+02
							Liver Hazard Index =	2.19E+00
							Nasal Hazard Index =	2.12E+00
							Kidney Hazard Index =	1.53E+02
							Eyes Hazard Index =	1.53E+02
							Immune Hazard Index =	1.53E+02
							Phalanges Hazard Index =	2.39E+00
							Neurological Hazard Index =	4.81E+00

-- – Not calculated, no toxicity values available
A – Not applicable
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 20 –Risk Characterization Summary for Outdoor Workers Carcinogens - Site I South

Scenario Timeframe: Future
Receptor Population: Outdoor Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	2,3,7,8-TCDD TEQ	1.35E-04	NA	(1)	1.35E-04
			Total PCBs	2.85E-05	NA	(1)	2.85E-05
						Surface Soil risk total =	1.63E-04
						Risk total =	1.63E-04

NA – Not applicable ; (1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 21 –Risk Characterization Summary for Outdoor Worker Non-Carcinogens - Site I South

Scenario Timeframe: Future
Receptor Population: Outdoor Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk (Hazard Index)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	2,3,7,8-TCDD TEQ	--	--	NA	--	--
			Total PCBs	Immune	1.99	NA	(1)	1.99
							Surface Soil Hazard Index Total =	1.99
							Hazard Index Total =	1.99
							Developmental Hazard Index =	--
							Immune Hazard Index =	1.99

-- – Not calculated, no toxicity values available; NA – Not applicable;
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 22 –Risk Characterization Summary for Construction Workers Carcinogens - Site I South

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Total PCBs	5.88E-07	NA	(1)	5.88E-07
						Surface Soil Risk Total	5.88E-07
Subsurface Soil	Subsurface Soil	Subsurface Soil	Antimony	--	NA	--	--
			Total PCBs	1.66E-06	NA	(1)	1.66E-06
						Subsurface Soil Risk Total	1.66E-06
Leachate	Leachate	Leachate	MCPP	--	NA	--	--
			Total PCBs	3.14E-06	NA	(1)	3.14E-06
Leachate	Air	Air	Chlorobenzene	NA	--	NA	--
			Chloroform	NA	1.89E-06	NA	1.89E-06
			Naphthalene	NA	--	NA	--
						Leachate Risk Total	5.03E-06
						Risk total =	7.28E-06

-- – Not calculated, no toxicity values available
NA – Not applicable
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 23 –Risk Characterization Summary for Construction Worker Non-Carcinogens - Site I South

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk (Hazard Index)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Total PCBs	Eyes, Immune, Phalanges	1.03E+00	NA	(1)	1.03E+00
							Surface Soil Hazard Index	1.03E+00
Subsurface Soil	Subsurface Soil	Subsurface Soil	Antimony	Longevity, Blood	2.72E+00	NA	(1)	2.72E+00
			Total PCBs	Eyes, Immune, Phalanges	2.91E+00	NA	(1)	2.91E+00
							Subsurface Hazard Index Total	5.63E+00
Leachate	Leachate	Leachate	MCPP	Kidney	5.74E-01	NA	(1)	5.74E-01
			Total PCBs	Eyes, Immune, Phalanges	5.50E+00	NA	(1)	5.50E+00
Leachate	Air	Air	Chlorobenzene	Liver and Kidney	NA	1.22E+00	NA	1.22E+00
			Chloroform	Nasal	NA	2.89E+01	NA	2.89E+01
			Naphthalene	Nasal	NA	1.99E+00	NA	1.99E+00
							Leachate Hazard Index Total	3.82E+01
							Hazard Index Total =	4.48E+01
							Eyes Hazard Index =	9.44E+00
							Immune Hazard Index =	9.44E+00
							Phalanges Hazard Index =	9.44E+00
							Longevity Hazard Index =	2.72E+00
							Blood Hazard Index =	2.72E+00
							Kidney Hazard Index =	1.79E+00
							Liver Hazard Index =	1.22E+00
							Nasal Hazard Index =	3.09E+01

NA – Not applicable
(1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 24 –Risk Characterization Summary for Construction Workers Carcinogens - Site L

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Subsurface Soil	Subsurface Soil	Subsurface Soil	Total PCBs	2.42E-06	NA	(1)	2.42E-06
						Subsurface soil risk total =	2.42E-06
						Risk total =	2.42E-06

NA – Not applicable; (1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 25 –Risk Characterization Summary for Construction Worker Non-Carcinogens - Site L

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Risk (Hazard Index)			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Subsurface Soil	Subsurface Soil	Subsurface Soil	Total PCBs	Eyes, Immune, Phalanges	4.24E+00	NA	(1)	4.24E+00
							Subsurface Soil Hazard Index Total =	4.24E+00
							Hazard Index Total =	4.24E+00
							Eyes Hazard Index =	4.24E+00
							Immune Hazard Index =	4.24E+00
							Phalanges Hazard Index =	4.24E+00

NA – Not applicable; (1) Risks for incidental ingestion and dermal contact were presented as one total.

Table 26 –Risk Characterization Summary for Young Child Resident Non-Carcinogens - Site N								
Scenario Timeframe: Future **Receptor Population:** Resident **Receptor Age:** Young Child								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Non-Carcinogenic Risk (Hazard Index)**			
					Ingestion	**Inhalation**	**Dermal**	**Exposure Routes Total**
Surface Soil	Surface Soil	Surface Soil	2,3,7,8-TCDD TEQ	Testes	2.40E+00	NA	1.48E-01	2.54E+00
							Surface Soil Hazard Index Total =	2.54E+00
							Hazard Index Total =	2.54E+00
							Testes Hazard Index =	2.54E+00
NA – Not applicable								

2.7.8 - Uncertainties

Uncertainty is inherent in the process of quantitative risk assessment because of the use of environmental sampling results, assumptions regarding exposure, and the quantitative representation of chemical toxicity. Potentially significant sources of uncertainty for this assessment are discussed in the HHRA and include analytical data, exposure estimates, toxicity estimates, and background conditions.

2.7.9 – Summary of Ecological Risk Assessment

The PRPs conducted two ecological risk assessments, with EPA oversight, under the RI/FS AOC signed in 2001 for Sauget Area 1. The first evaluation, conducted in 2001, concluded there was no habitat for ecological receptors at Sites G, H, I, L, and N; therefore no potential ecological risks were identified at these sites.

The 2001 ecological risk assessment also focused on the floodplain soils, surface water, and sediments associated with Dead Creek Segment F, including Borrow Pit Lake, and floodplain soil in the Transect Areas associated with upstream segments of Dead Creek. This ecological risk assessment concluded that a response action was required in these areas. As a result, the dredging of contaminated sediments in Dead Creek, Site M, and Borrow Pit Lake was conducted during the Dead Creek Removal Action as discussed in Section 2.2 "Site History and Enforcement Activities."

The second ecological risk assessment, conducted in 2002, evaluated potential impacts to fish and wildlife due to exposure to residual chemicals of concern in creek bottom soils after the 2001 Dead Creek Removal Action. A terrestrial evaluation of the de-watered creek bottom soils of Dead Creek segments C, D, and E was completed in 2009. The Site-specific ecological evaluation concluded that the Dead Creek Removal Action addressed the identified ecological risks and that no further remedial action within Dead Creek Segments B, C, D, E, and F, Site M, Borrow Pit Lake, and Transect Area associated with upstream segments of Dead Creek was necessary (Dead Creek HHRA 2006).

2.7.10 - Risk Assessment Conclusions

The 2001 ecological risk evaluation concluded there was no habitat for ecological receptors at Sites G, H, I, L, and N; therefore no ecological risks were identified at these sites.

The 2006 Dead Creek Creek Bottom Soils HHRA and 2002 ecological risk assessment concluded that the Dead Creek Removal Actions have eliminated risks above EPA's acceptable levels for human health and the environment in Dead Creek Segments B, C, D, E, and F, Site M, Borrow Pit Lake and Transect Area[17].

The RI concluded Site I North and Site N are not contaminant source areas. Neither area contains contamination in soils above levels of concern, e.g., containing levels which potentially threaten human health or the environment under current exposure scenarios[18]. Site N was evaluated in the Site-wide HHRA for both future commercial/industrial land use, as well as a hypothetical future residential land use scenario. No unacceptable risks or hazards were identified for Site N for the commercial/industrial land use scenario, but hazards were identified under the future residential land use scenario. However, the Sauget Area 1 Sites (G, H, I North, I South, L, and N) have been used for industrial purposes for many years (since the 1930's or earlier). The sites within Sauget Area 1 are zoned commercial/industrial, and it is likely that the sites will continue to be used well into the reasonably foreseeable future for commercial/industrial purposes. The land use for the foreseeable future for Site N is commercial/industrial and there were no unacceptable risks or hazards identified at Site N under the commercial/industrial land use scenario; therefore, no unacceptable risks for commercial/industrial use are identified at Site N.

The remaining contaminant source areas at the Sauget Area 1 Site are the disposal areas at Sites G, H, I South, and L. Risks or hazards above EPA's acceptable level for acceptable levels for human health were identified in these disposal areas and summarized below.

In summary, risks and hazards were within or below EPA's target risk range of $1x10^{-4}$ to $1x10^{-6}$ and a target hazard index of 1 on a target endpoint basis and, therefore, no COCs were identified in the soils, sediments, and surface water in the following areas:

- Dead Creek Segments B, C, D, E, and F, Site M and Borrow Pit Lake

[17] Sauget Area 1 Dead Creek Final Remedy Creek Bottom Soil Human Health Risk Assessment (ENSR Corporation, April 2006)
[18] Sauget Area 1 – Human Health Risk Assessment, (ENSR International, June 2001)

- Transect Areas
- Site I North
- Site N

Some risks or hazards exceeded EPA's target risk range of $1x10^{-4}$ to $1x10^{-6}$ and/or a target hazard index of 1 on a target endpoint basis and, therefore, COCs were identified the following Sites:

- Site G – construction worker receptor
- Site H – utility worker and construction worker receptors
- Site I South– outdoor industrial worker and construction worker receptors
- Site L – construction worker receptor

The potential risk to human health from COCs in soils and groundwater sources at Sites G, H, I South, and L drives the need for remedial action at OU1 of the Sauget Area 1 Site. The response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.8 – Remedial Action Objectives

Remedial action objectives (RAOs) are goals specific to media or operable units for protecting human health and the environment. Risk can be associated with current or potential future exposures. RAOs should be as specific as possible, but not so specific that the range of alternatives to be developed is unduly limited.

The Site-wide HHRA (ENSR, 2001) recognized the following receptors for current and future land-use scenarios: industrial workers, construction/ utility workers, trespassing teenagers, residents, and child, adolescent, and adult recreationalists. Potential exposure routes for each receptor are depicted in the conceptual site model (Figure 2). Current land uses within OU1 consists of industrial and commercial. For the purposes of the HHRA and the development of RAOs, EPA assumed that future land uses of all properties would be the same as current land uses (e.g, industrial and commercial).

The following RAOs have been identified for the Sauget Area 1 Site based on the summary of receptor potential risks and hazards for the exposure scenarios presented in the HHRAs:

Site G

- Prevent unacceptable risks to human receptors (construction workers, utility workers) resulting from inhalation of COCs found in groundwater and leachate during excavation work.
- Prevent unacceptable risks to human receptors (construction workers, utility workers) resulting from ingestion and dermal contact with subsurface soils during excavation work.
- Prevent human exposure to vapor intrusion into indoor air at levels that result in unacceptable risk from COCs in waste materials, soils, or groundwater.

- Prevent unacceptable risk to human receptors related to landfill gas generation.
- Minimize current and future migration of COCs from soil and waste to groundwater at levels causing unacceptable risks to human receptors.
- Minimize migration of principal threat/mobile source material.

Site H

- Prevent unacceptable risks to human receptors (construction workers, utility workers) resulting from inhalation of COCs found in groundwater, leachate, and subsurface soils during excavation work.
- Prevent unacceptable risks to human receptors (construction workers, utility workers) resulting from ingestion and dermal contact with leachate and subsurface soils during excavation work.
- Prevent unacceptable risks to human receptors (utility workers) resulting from inhalation of COCs found in soil vapor and waste during excavation work on utility lines.
- Prevent human exposure to vapor intrusion into indoor air at levels that result in unacceptable risk from COCs in waste materials, soils, or groundwater.
- Prevent unacceptable risks to human receptors (utility workers) resulting from ingestion or dermal exposure to COCs found in waste materials and soil during excavation work on utility lines.
- Prevent unacceptable risk to human receptors related to landfill gas generation.
- Minimize current and future migration of COCs from soil and waste to groundwater at levels causing unacceptable risks to human receptors.
- Minimize migration of principal threat/mobile source material.

Site I South

- Prevent unacceptable risks to human receptors (outdoor industrial/construction workers) resulting from ingestion or dermal exposure to COCs found in surface soils.
- Prevent unacceptable risks to human receptors (construction workers) resulting from ingestion or dermal exposure to COCs found in surface and subsurface soils and leachate during excavation work.
- Prevent unacceptable risks to human receptors (construction workers) resulting from inhalation of COCs found in leachate during excavation work.
- Prevent human exposure to vapor intrusion into indoor air at levels that result in unacceptable risk from COCs in waste materials, soils, or groundwater.
- Prevent unacceptable risk to human receptors related to landfill gas generation.
- Minimize current and future migration of COCs from soil and waste to groundwater at levels causing unacceptable risks to human receptors.
- Minimize migration of principal threat/mobile source material.

Site L

- Prevent unacceptable risks to human receptors (construction workers) resulting from ingestion or dermal exposure to COCs found in subsurface soils during excavation work.

A cleanup that achieves these RAOs will be protective of human health and the environment as it will address current and future potential risks above EPA-acceptable levels in Site media.

Remedial Goals

For potentially carcinogenic risk results, COCs are identified as those COPCs that cause an exceedance of the target risk level of $1x10^{-4}$. For noncarcinogenic hazard results, COCs are identified as those COPCs that cause an exceedance of the toxic-endpoint specific HI of 1. Remediation goal options (RGOs) have been calculated for those COPCs identified as COCs in the HHRAs. RGOs are summarized in Appendix C of this ROD.

2.9 – Description of Alternatives

This section presents the remedial alternatives for OU1, which are numbered to correspond with the numbering system used in the FS Report. The alternatives are described more fully in Section 2.9.2.

In accordance with EPA guidance, the potential remedial alternatives identified in the FS were screened against three broad criteria: (1) effectiveness (both short-term and long-term), (2) implementability (including technical and administrative feasibility), and (3) relative cost (capital and operation and maintenance (O&M)). The purpose of the screening evaluation was to reduce the number of alternatives chosen for a more thorough analysis.

2.9.1 - Common Element of Alternatives

All of the alternatives, except the Alternative 1 ("no action" alternative) and Alternative 2, which do not include engineered covers, require the following common elements:

Engineered Covers - Engineered covers minimize the potential for exposure to COCs in soils and waste in covered areas. The types of engineered covers selected for a remedial alternative will vary depending on the existing uses of the site and the types of fill or waste materials that are present in the site. The cover designs will also vary depending on whether or not the alternative includes technologies that introduce air into the saturated zone beneath the capped area (e.g., biosparging). Permeable covers are more appropriate in these situations.

The types of engineered covers included in the remedial alternatives for the Sauget Area 1 Sites include RCRA Subtitle C designed caps, 35 Illinois Administrative Code (IAC) § 724[19] compliant soil caps, 35 IAC § 724 compliant crushed rock caps, and asphalt caps.

[19] Subtitle C of RCRA, 42 U.S.C §§ 6921-6939e, directs the EPA Administrator, among other things, to regulate the owners and operators of hazardous waste treatment, storage, and disposal ("TSD") facilities, including landfills. Pursuant to this statutory scheme, EPA has promulgated regulations, codified at 40 C.F.R. Parts 264 and Illinois has adopted analogous regulations codified at 35 IAC Part 724 establishing standards applicable to hazardous waste generators, transporters, and TSD facilities. The federal regulations governing hazardous waste landfill closure are at 40 CFR Part 264, Subpart G (Closure and Post-Closure) and Subpart N (Landfills) *See* 40 CFR § 264.310. Illinois has been authorized by EPA to implement RCRA through its state law and regulations. The corresponding Illinois regulations are 35 IAC Part 724, Subpart G (Closure and Post-Closure Care) and Subpart N (Landfills) *See*

RCRA Subtitle C designed caps are multi-layer caps that promote surface water drainage and minimize surface water infiltration into subsurface soils that lie beneath the capped area. They include a low-permeability layer underlain by a gas collection layer and overlain by a drainage layer and protective soil cover and vegetative layer. At traffic areas, the surface layer of a RCRA Subtitle C designed cap can be constructed of alternate materials such as crushed rock or asphalt pavement.

A 35 IAC § 724 compliant soil or crushed rock cap will meet the performance standards of a RCRA Subtitle C cap, except when the component requiring long-term minimization of migration of liquids (through the installation of an impermeable cap), is not appropriate, such as with the implementation of Alternative 5 (*see* Section 2.10.2). Both soil and crushed rock caps will employ a minimum of two feet of clean material to minimize the potential for human exposure to COCs in soil and waste. Crushed rock caps will use granular material to cover an area.

Details of the engineered cover designs for Sauget Area 1 would be developed during the remedial design process.

Containment Cell Operation and Maintenance (O&M) - The existing containment cell is a RCRA and TSCA-compliant containment cell that was constructed as part of the Dead Creek Removal Action ordered by EPA in 2000 and is located immediately west of Creek Segment B and south of Site G. The materials that were placed in the containment cell included sediments and creek-bottom soils excavated from Dead Creek, Site M and Borrow Pit Lake.

EPA's May 2000 UAO with Monsanto Company and Solutia, Inc. for the Dead Creek Removal Action states that installation of the final engineered cover on the Containment Cell is required under that UAO. This Removal Containment Cell closure requirement is reflected in the May 31, 2000 Action Memorandum for the Dead Creek Removal. Therefore; final closure of the Containment Cell is not part of the Selected Remedy.

Additionally, the UAO states that requirements associated with the long-term operation and maintenance of the containment cell will be addressed in the RI/FS process for the Site. Pursuant to the RI/FS, the required activities relating to the O&M of the containment cell are detailed in the Containment Cell Operation and Maintenance Plan (Golder, 2008). The O&M activities include the following: i) regular inspections of the cap; ii) sampling of primary and secondary leachate with analysis for pH, specific conductance, PCBs, and chlorinated VOCs; iii) collection and treatment of leachate; iv) quarterly sampling of treatment system effluent with analysis for VOCs, SVOCs, PCBs, and metals; v) quarterly sampling of selected monitoring wells with analysis for VOCs, PCBs, and metals; and vi) maintenance and repairs as needed (e.g., replacement or repair of pumps and mowing, fertilizing, and re-seeding of cell cap).

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35 IAC § 724.410.. These requirements are equivalent to the federal requirements. In addition, the Illinois solid waste landfill requirements for non hazardous waste are presented in 35 IAC Part 807.

Monitoring Well Network - The monitoring well network involves installation of a monitoring well network and periodic groundwater sampling and testing for VOCs, SVOCs, and selected geochemical parameters. The purpose of the monitoring well network is to monitor the effectiveness of the soil and groundwater source area remedy of OU1, as set forth in this ROD. The exact number and location of wells in the groundwater monitoring network will be established during the remedial design phase.

Institutional and Access Controls - Institutional controls are designed to control access to the Site, manage construction or other intrusive activities that may disturb soil or waste, minimize potential exposure to COCs, and ensure that groundwater is not used for drinking water purposes. Institutional controls that could be implemented include deed restrictions, zoning restrictions and access restrictions such as fences or warning signs. At a minimum, institutional controls will be implemented in accordance with the Illinois Uniform Environmental Covenant Act to restrict residential development of the Site. Consistent with expectations set out in the Superfund regulations, none of the remedies rely exclusively on institutional controls to achieve protectiveness. A detailed description of the institutional controls for Sauget Area 1 will be developed in an Institutional Controls Implementation Plan to be prepared during the remedial design process.

No Further Action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N – No unacceptable risks were identified for Dead Creek Segments A through F, Borrow Pit Lake, Site M, Site I North, and Site N; therefore, no further remedial actions are required for these areas.

2.9.2 – Summary of Remedial Alternatives

Alternative 1:

- **No Action**

Estimated Capital Cost: $0
Estimated Total O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

Regulations governing the Superfund program require that the "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, EPA would take no action at the Site to prevent exposure to the soil and groundwater source contamination.

Alternative 2:

- **Containment Cell O&M**
- **Monitoring Well Network**
- **Institutional and Access Controls: Sites G, H, I South, and L**
- **No Further Action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N**

Estimated Capital Cost: $524,895
Estimated Total O&M Cost: $2,517,460
Estimated Present Worth Cost: $3,102,610
Estimated Construction Timeframe: 3-6 months

This alternative combines institutional and access controls, the operation and maintenance of the containment cell, the installation and operation of a monitoring well network, and no further action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N, all of which were described under "Common Elements" above.

Alternative 3:

- **Recovery of Pooled DNAPL at Site I South**
- **RCRA Subtitle C Designed Caps at Sites G, H, I South, and L**
- **Asphalt Pavement Cap at Site G West**
- **Utility Relocation in the Utility Corridor adjacent to Site H, south of Queeny Avenue**
- **Containment Cell O&M**
- **Monitoring Well Network**
- **Institutional and Access Controls: Sites G, H, I South, and L**
- **No Further Action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N**

Estimated Capital Cost: $9,098,788
Estimated Total O&M Cost: $3,660,803
Estimated Present Worth Cost: $12,819,844
Estimated Construction Timeframe: 1 year

Alternative 3 combines the components of Alternative 2 with the pooled DNAPL recovery at Site I South, RCRA Subtitle C designed caps at Sites G, H, I South, and L, and utility relocation.

Institutional and access controls, containment cell O&M, the installation and operation of a monitoring well network, and no further action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N were described under "Common Elements" above. The additional components of Alternative 3 are described below.

Recovery of Pooled DNAPL at Site I South - This is a removal technology that involves recovery of an accumulation of DNAPL that is pooled at the base of a water-bearing zone. The DNAPL is pumped from an extraction well and collected in a tank. When a sufficient volume has accumulated in the tank, the DNAPL is transported off-Site for disposal at a permitted facility.

Pooled DNAPL recovery at Site I South bedrock well (BR-I) has already been performed on an every-other-week schedule since November 2008. DNAPL serves as a large and significant source of dissolved contaminants to the groundwater plumes. Removal of the pooled DNAPL will therefore help reduce the time it takes for the plume to be remediated. Implementation of this remedy component will involve bringing a permanent electrical power source to BR-I,

programming the pump controller for automated operation, and obtaining a larger tank for storage of the recovered fluids.

Initially, the pump will be operated once per day. When the rate of DNAPL recovery has diminished sufficiently to the point that daily operation has limited effectiveness, the pump will be operated twice per week. When recovery using the weekly schedule has reached its limit of effectiveness, the DNAPL removal will be conducted once per month. When the limit of practicable recovery has been reached, the DNAPL recovery will be discontinued. Fluid levels will be monitored at BR-I and at nearby well A1-19. Recovered DNAPL will be transported to an approved off-site facility for incineration.

Under this action, the extent of pooled DNAPL in bedrock in the area surrounding BR-I will be investigated during the remedial design phase of the project. Recovery of pooled DNAPL from additional bedrock wells in the area of BR-I would be performed if this action is determined to be productive based on the results of this investigation.

The pooled DNAPL that is present at Site I South is considered a principal threat waste material. The pooled DNAPL recovery component will address this principal threat waste material through treatment and reduce the mass of COCs in the source area at Site I South.

RCRA Subtitle C Designed Caps at Sites G, H, I South, and L – This component involves installation of impermeable caps whose designs would vary depending on the current and future uses of the sites. Capping with impermeable materials mitigates to the greatest extent practicable the potential for direct contact with or release of waste at these sites, and can greatly reduce the potential for subsurface leachate generation where leachable waste is present.

At Site G, a RCRA Subtitle C designed cap would be installed at the northern portion of the fenced area as shown on Figure 5. The conceptual footprint of the RCRA Subtitle C designed cap within the fenced area corresponds to the approximate extent of waste and fill based on source area boundary investigations conducted during the RI. Waste was not found in the southern portion of the fenced area at Site G, and therefore the cap would not need to cover that area. At Site G West, asphalt pavement would be installed to cap the existing parking area surrounding the Wiese Engineering building.

At Site H, which is an undeveloped property, capping under this alternative would involve installation of a RCRA Subtitle C designed cap for the entire area of Site H, as shown on Figure 5. The conceptual footprint of the RCRA subtitle C designed cap at Site H corresponds to the approximate extent of waste and fill based on source area boundary investigations conducted during the RI.

Site I South is located at an active industrial facility, Cerro Flow Products. Capping would involve installation of a RCRA Subtitle C designed cap for the area of Site I South as shown on Figure 6. Site I South is used for truck trailer parking and has two roads, a rail spur, truck scales, and a guard shack within its boundary. In addition, the eastern side of Cerro's employee parking lot is located within the boundary of Site I South. The site is covered by clean, purchased stone or surplus concrete that was placed to fill depressions and maintain grades for truck trailer parking.

Under this Alternative, the RCRA Subtitle C designed cap at Site I South would need to incorporate the existing features of the site, and in some locations (such as the rail spur) existing

stone/concrete pavement will have to serve as the final cover. Considering the present and future use of Site I South for truck trailer parking, the final surface layer of the installed cap would be crushed stone instead of a protective soil cover and vegetated layer. The conceptual footprint of the RCRA subtitle C designed cap at Site I South corresponds to the approximate extent of waste and fill based on source area boundary investigations conducted during the RI.

At Site L, capping would involve installation of a RCRA Subtitle C designed cap, which would correspond to the approximate extent of waste and fill based on the source area boundary investigations conducted during the RI.

The cap designs for Sites G, H, I South, and L would each provide for the management of storm-water runoff.

Utility Relocation - This component includes the following: i) relocation of a water supply line that runs through Site I South to the Sauget Village Hall; ii) relocation of a 14-inch diameter fuel pipeline that is located in the utility corridor along Queeny Avenue adjacent to Site H; and iii) relocation of a buried telephone cable located in the utility corridor along Queeny Avenue adjacent to Site H. The replacement water line and fuel pipeline will be placed along alternative corridors routed around the fill areas. The replacement telephone line will either be placed along an alternative corridor routed around the Sauget Area 1 fill areas or installed on overhead poles.

Relocation of these utilities will prevent utility workers performing repair or maintenance activities from potentially coming into contact with wastes in Site I South and the principal threat waste that was encountered in the utility corridor adjacent to Site H.

Alternative 4:

- **Recovery of Pooled DNAPL at Site I South**
- **RCRA Subtitle C Designed Caps at Sites G, H, I South, and L**
- **Asphalt Pavement Cap at Site G West**
- **Leachate Control at Sites G, H, and I South**
- **Utility Relocation in the Utility Corridor adjacent to Site H, south of Queeny Avenue**
- **Containment Cell O&M**
- **Monitoring Well Network**
- **Institutional and Access Controls: Sites G, H, I South, and L**
- **No Further Action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N**

Estimated Capital Cost: $10,891,077
Estimated Total O&M Cost: $11,560,817
Estimated Present Worth Cost: $22,546,242
Estimated Construction Timeframe: 1 year

Institutional and access controls, containment cell O&M, the installation and operation of a monitoring well network, and no further action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N were described under "Common Elements"

above. Pooled DNAPL recovery, RCRA Subtitle C designed caps and utility relocation were described under Alternative 3 above. The additional component in Alternative 4 is leachate control at Sites G, H, and I South.

Leachate Control - The leachate control component would include installation of a grid of wells and installation of leachate pre-treatment systems at Sites G, H, and I South to capture and treat recovered leachate prior to discharging it to the American Bottoms Regional Treatment Facility, where it would be treated further prior to subsequent discharge into the Mississippi River in compliance with the facility's NPDES permit.

Prior to designing implementation of this action, a pre-design investigation would be required to identify any areas where the base of the waste is above the saturated zone; leachate recovery wells would not be installed in those areas. The leachate recovery wells will be screened across the entire saturated thickness of the fill areas and would be equipped with air-activated recovery pumps that operate only when fluids are present.

Alternative 5:

- **Recovery of Pooled DNAPL at Site I South**
- **Pulsed Air Biosparging at Residual DNAPL Areas at Sites G, H, and I South**
- **35 IAC § 724 Compliant Soil or Crushed Rock Caps at Sites G, H, I South, and L**
- **Asphalt Pavement Cap at Site G West**
- **Utility Relocation in the Utility Corridor adjacent to Site H, south of Queeny Avenue**
- **Containment Cell O&M**
- **Monitoring Well Network**
- **Institutional and Access Controls: Sites G, H, I South, and L**
- **No Further Action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N**

Estimated Capital Cost: $8,315,471
Estimated Total O&M Cost: $6,310,857
Estimated Present Worth Cost: $14,784,465
Estimated Construction Timeframe: 1 year

Institutional and access controls, containment cell O&M, the installation and operation of a monitoring well network, and no further action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N were described under "Common Elements" above. Pooled DNAPL recovery at BR-I and utility relocation were described under Alternative 3. The additional components in Alternative 5 are pulsed air biosparging at the residual DNAPL areas at Sites G, H, and I South and the installation of 35 IAC § 724 compliant soil or crushed rock caps at Sites G, H, I South and L instead of the impermeable RCRA Subtitle C designed caps described in Alternatives 3 and 4.

Pulsed Air Biosparging at Residual DNAPL Areas at Sites G, H, and I South – The operation of the pulsed air biosparging (PABS) systems would be characterized by high flow rate pulsed sparging of atmospheric air to the aquifer to promote in-situ aerobic biodegradation and

thereby reduce the mass of COCs in the MHU and DHU. Each PABS system is comprised of a grid of nested injection well pairs screened in the MHU and DHU and connected to a compressor to supply atmospheric air. The well grids would be located in the areas of residual DNAPL in the MHU and DHU that were identified at Sites G, H, and I South during the DNAPL characterization and remediation study, as shown on Figure 7. The conceptual layout shown on Figure 7 includes one PABS system at Site G, one system at Site H, and several separate systems at Site I South.

The area of residual DNAPL at Site I South extends beneath former Creek Segment A and into an area of the Cerro facility where several buildings are located. These areas with buildings are not suitable for implementation of PABS systems due to the presence of the buildings and the presence of an impermeable liner at the base of former Creek Segment A, which was closed and remediated in 1990-1991. This is because soil vapors will tend to accumulate in the waste and fill materials in the unsaturated zone beneath the impermeable barriers such as a building foundation or landfill liner, or cause the release of vapors into buildings. The balance of Site I South that is underlain by residual DNAPL would be treated with pulsed air biosparging. At the location of each sparge well pair there would also be a passive vent well to recover vapors that would be treated in drums of granular activated carbon.

To evaluate the feasibility and effectiveness of full-scale operations of the PABS system, a pilot test would be conducted for a period of approximately one year to determine operational parameters, measure performance characteristics, and verify the optimal spacing of the biosparge well pairs.

The pilot test would include the following: baseline soil and groundwater sampling and testing; installation of four sparge well pairs with passive vent wells; installation of groundwater monitoring wells at and near the pilot test area; construction of the pilot system and piping; operation of the pilot test for one year; and post-test soil and groundwater sampling to estimate COC mass removal. The pilot test would include monitoring and control of emissions from the passive vent wells that are collocated with the sparge well pairs. As appropriate, passive vent wells would also be installed next to key buildings for monitoring during the pilot test. Additionally, indoor air monitoring will be required at nearby building to ensure indoor air quality is protective to indoor workers during the pilot test of the PABS systems.

Following completion of the pilot test and prior to full-scale design of the PABS systems at Sites G, H, and I South, additional soil boring investigations would be needed to more precisely delineate the extent of the residual DNAPL areas shown on Figure 7.

Performance of Pulsed Air Biosparging

Until a pilot test is performed, it is not possible to precisely estimate the source mass removal that can be achieved in the MHU and DHU using operation of a PABS system. However, some studies have shown that under different circumstances than those in Sauget, source mass removal can result in as much as 75% to 90% mass reduction (Brown et al., 1998; Machackova; Sale et al., 2008; Sperry et al., 2001).

Generation and Management of Soil Vapors During Pulsed Air Biosparging

The limited injection duration (conceptually several hours twice per week) that is characteristic of a PABS system greatly reduces, but does not eliminate, the volume of air that reaches the unsaturated zone, compared to a continuously operated air sparging system. Controlling the volume and frequency of air sparging and monitoring the indoor air of nearby buildings will be required in order to prevent the vapors generated by the PABS systems from becoming unacceptable risks to indoor workers present in those buildings. The nearby buildings and their approximate distances from the closest PABS well pairs include: Sauget Village Hall, 200 ft southeast; Cerro Flow Products, 150 ft west; Wiese Engineering building, 400 ft west; and Metro Construction Equipment, 150 ft east (relative to Site G).

Generation of Soil Vapors

Compressed atmospheric air that is sparged into the MHU and DHU well pairs during the pulsed biosparge events will form air channels that extend into the MHU and DHU. The air channels will eventually reach the base of the SHU. When the sparging is terminated, the air channels will collapse, forming trapped air bubbles in pore spaces within the MHU and DHU.

The pulsed sparging will be performed using atmospheric air, which contains (by volume) approximately 78% nitrogen, 21% oxygen, and small amounts of other gases, including water vapor. The oxygen fraction in the trapped air bubbles in the MHU and DHU will diffuse into the groundwater and be utilized for biodegradation. However, most of the nitrogen in the trapped air bubbles will not diffuse into groundwater. The trapped air bubbles are likely to be mobilized during subsequent pulsed sparging events and will eventually reach the base of the SHU.

Due to volatilization of COCs in the MHU and DHU during pulsed biosparging events, the air that reaches the SHU will contain measurable concentrations of volatile COCs, especially during the first few months of operation. After this initial period of operation, COC mass removal will be dominated by biodegradation in the MHU and DHU resulting from diffusion of oxygen from trapped air bubbles.

Some of the air bubbles that reach the base of the SHU will move into the fill and waste materials, especially at locations where the waste and fill materials extend to depths at or below the base of the SHU. Some air will also likely accumulate at the base of the SHU, which has a lower permeability than the MHU and DHU.

Management of Soil Vapors

As shown on Figure 7, the passive vent wells co-located with the sparge well pairs will be screened to a depth of 35 feet through the fill and waste and into the upper few feet of the MHU. These vent wells are intended as exit points for air bubbles that accumulate at the base of the SHU, as well as air bubbles that enter the waste and fill zone. However, most of the air that enters the waste and fill is expected to vent directly through the permeable soil or crushed rock covers that are included as a remedy component of Alternative 5. The volume and frequency of the pulsed air additions will be controlled such that air emissions at the surface do not result in a significant risk. Determining the amount and frequency of pulsed air sparging will be investigated in more detail during the one-year PABS pilot test.

35 IAC § 724 Compliant Soil Cap or 35 IAC § 724 Compliant Crushed Rock Caps at Sites G, H, I South, and L – A 35 IAC § 724 compliant soil or crushed rock cap will meet the performance standards of a fully designed RCRA Subtitle C cap, except the component requiring long-term minimization of migration of liquids, which is not appropriate in the context of implementing this Alternative. (See Section 2.10.2 below). Therefore, the 35 IAC § 724 compliant caps will not include the low-permeability component of the RCRA Subtitle C designed caps. Alternative 5 includes 35 IAC § 724 compliant soil or crushed rock caps at Sites G, H, I South, and L, which will mitigate against exposure to the waste and affected soils while providing permeability for air transfer and infiltration of moisture. Soil or crushed rock caps are more appropriate for use with the PABS systems than impermeable RCRA Subtitle C designed caps. As mentioned, this is because soil vapors will tend to accumulate in the waste and fill materials in the unsaturated zone beneath an impermeable barrier such as a Subtitle C designed cap. The conceptual footprint of the soil or crushed rock caps at Sites G, H, L, and I South are shown on Figures 5 and 6, respectively.

Under this Alternative, at Site G, the 35 IAC § 724 compliant soil or crushed rock cap would be constructed at the northern portion of the fenced area as shown on Figure 5. The conceptual footprint of the soil or crushed rock cap within the fenced area corresponds to the approximate extent of waste and fill discovered to exist based on boundary trenching conducted during the RI. Waste was not found in the southern portion of the fenced area at Site G, and therefore the soil or crushed rock cap would not include that area. The cross sections of the soil or crushed rock cap for Site G are shown on Figure 8. At Site G West, asphalt pavement would be installed to cap the parking area surrounding the Wiese Engineering building.

At Site H, which is an undeveloped property, the soil or crushed rock cap would include the entire area of Site H as shown on Figure 5. The conceptual footprint of the 35 IAC § 724 compliant soil or crushed rock cap at Site H corresponds to the approximate extent of waste and fill based on source area boundary investigations conducted during the RI.

At Site I South, a crushed rock cap would be constructed instead of a soil cap so that Site I South can continue to be used for truck trailer parking. The crushed rock cap at Site I South would need to incorporate the existing features of the Site, and in some locations the existing pavement may need to serve as the final cover. The conceptual footprint of the Site I South 35 IAC § 724 compliant crushed rock cap is shown on Figure 6 and corresponds to the approximate extent of waste and fill based on source area boundary investigations conducted during the RI. The cross section of the crushed rock cap for Site I South is shown on Figure 8.

At Site L, capping would involve installation of a 35 IAC § 724 compliant soil or crushed rock cap, which would correspond to the approximate extent of waste and fill based on the source area boundary investigations conducted during the RI.

2.10 – Comparative Analysis of Alternatives

As required by CERCLA, nine criteria were used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the

Record of Decision summarizes the performance of each alternative against the nine criteria and notes how they compare to the other options under consideration.

The nine evaluation criteria fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria, which include overall protection of human health and the environment and compliance with ARARs, are requirements that each alternative must meet in order to be eligible for selection. Primary balancing criteria, which include long-term effectiveness and permanence, reduction of toxicity, mobility, or volume of contaminants through treatment, short-term effectiveness, implementability, and cost, are used to weigh major trade-offs among alternatives. Modifying criteria include state/support agency acceptance and community acceptance. In the final balancing of trade-offs between alternatives, upon which the final remedy selection is based, modifying criteria are of equal importance to the balancing criteria. The nine evaluation criteria are discussed below.

2.10.1 - Overall Protection of Human Health and the Environment

This criterion assesses how well the alternatives achieve and maintain protection of human health and the environment.

This evaluation criterion assesses whether each remedial alternative protects human health and the environment. This assessment focuses on how an alternative achieves protection over time and indicates how each source of contamination would be minimized, reduced, or controlled through treatment, engineering, or institutional controls. The evaluation of the degree of overall protection associated with each alternative is based largely on the exposure pathways and scenarios set forth in the baseline human health risk assessment (HHRA).

Alternatives 1 and 2 are not protective of human health or the environment because they do not meet the RAOs developed for the affected soils and waste at Sites G, H, I South, and L.

The engineered caps included in Alternatives 3, 4, and 5 achieve the RAO for surface and subsurface soil and the RAO for waste and leachate. These engineered caps, in conjunction with the institutional controls, minimize the potential for human exposure to COCs at the fill area and prevent erosion of the fill areas.

Alternatives 3 and 4 achieve the soil vapor RAO. Results of the vapor intrusion HHRA indicate that concentrations of COCs found in soil vapor do not pose an unacceptable risk to human receptors in existing building. Alternative 5 can achieve the soil vapor RAO provided that soil vapors generated during operation of the PABS systems are carefully monitored and the PABS operations are operated, managed, and maintained so as to prevent potential unacceptable risks to indoor workers in nearby buildings. Alternatives 3, 4, and 5 include institutional controls that will prevent construction of new buildings on the source areas without vapor controls.

Because Alternatives 1 and 2 are not protective of human health and the environment, they are eliminated from consideration under the remaining eight criteria.

2.10.2 - Compliance with Applicable or Relevant and Appropriate Requirements

This criterion assesses how the alternatives comply with regulatory requirements. Federal and state regulatory requirements that are either applicable or relevant and appropriate are known as ARARs. Only state requirements that are more stringent than federal requirements are ARARs. There are three different categories of ARARs: chemical-specific, action-specific, and location-specific ARARs.

Landfill Closure/Post-Closure

Alternatives 3 through 5 can be designed and implemented to comply with ARARs relating to closure and post-closure requirements for landfills, specifically 35 IAC § 724, which contains the standards for owners and operators of hazardous waste treatment, storage, and disposal facilities, including landfills. Although the 35 IAC § 807 standards for solid waste landfills are relevant to Sauget Area 1, they are not appropriate because the hazardous waste landfill requirements of 35 IAC § 724 are better suited to Site conditions.

The engineered covers in Alternatives 3, 4, and 5 all comply with 35 IAC § 724.410's performance standards of functioning with minimal maintenance, promoting drainage, and minimizing erosion of the cap, and could accommodate settling and subsidence so that the cap's integrity is maintained. However, 35 IAC § 724.410's performance standard for providing long-term minimization of migration of liquids (the RCRA Subtitle C designed cap proposed in Alternatives 3 and 4) is not appropriate for Sauget Area 1 because of the following:

- Results from a mass flux evaluation indicates that estimated mass flux of key COCs from leaching of unsaturated source materials is small compared to estimated mass flux of the COCs due to lateral groundwater flow;
- The lower portion of waste at the Sauget Area 1 sites is below the water table. Installation of caps to minimize infiltration of rainwater at Sauget Area 1 would not address the flushing effects from the rising and falling water table;
- No principal threat liquids or mobile source materials were identified in the wastes above the water table at the Sauget Area 1 sites; and
- Contaminants in impacted groundwater at Sauget Area 1 naturally attenuate before reaching the River, or are captured by the Sauget Area 2 Groundwater Migration Containment System.

Alternatives 3 and 4 involve installation of impermeable caps, which provide for greater protection from direct contact with waste materials. However, as indicated, because the lower portion of waste at the Sauget Area 1 Sites is already below the water table, and no principal threat liquids or mobile source materials were identified in the wastes above the water table, and the mass flux evaluation indicates that estimated mass flux of key contaminants of concern (COCs) is due to lateral groundwater flow (and not from the potential leaching effect of COCs from infiltrating rainfall), EPA has concluded that the installation of impermeable caps to minimize infiltration of rainwater at Sauget Area 1 would not prevent or reduce migration of

contaminated groundwater. Therefore, we conclude that the performance standard for providing long-term minimization of migration of liquids is not required to be Section 724.410 compliant in Suaget Area 1. Alternative 5, which does not require the installation of impermeable caps, is thus Section 724.410 compliant[20].

PCB Regulation of Remediation Waste

PCB-contaminated soils and wastes in the disposal areas in Sauget Area 1 Sites G, H, I South, and L meet the definition of a PCB remediation waste as defined under 40 CFR § 761.3[21] and thus are regulated for cleanup and disposal under 40 CFR Part 761. As set forth below, Alternatives 3, 4, and 5 will comply with the ARARs related to PCB remediation wastes and TSCA risk-based disposal method set forth at 40 CFR § 761.61.

As indicated in Section 2.2, below, under the UAO issued by EPA, soils and sediments have already been excavated from Dead Creek and Site M and placed in a RCRA and TSCA compliant containment cell. As indicated, pursuant to EPA's 2000 modified UAO for the Dead Creek Removal Action, the PRPs, with EPA oversight, excavated approximately 58,300 cubic yards of PCB contaminated sediments and soils from Dead Creek Segments B, C, D, E, F, and Site M. Later, in 2005-2006, pursuant to an amendment to the UAO, the PRPs excavated creek bottom soils exceeding target risk levels from Creek Segments B, D, and F and Borrow Pit Lake; and installed an armored impermeable liner throughout the entire length of Creek Segment B. These removal actions have eliminated risks above EPA's acceptable levels for human health and the environment in the Dead Creek, Site M, and Borrow Pit Lake[22] Thus, the most toxic and mobile of the PCB remediation waste has already been addressed in Sauget Area 1.

The remaining PCB containing areas at the Site are the disposal areas at Sites G, H, I South, and L. These disposal areas contain municipal and industrial waste materials, including crushed or partially crushed drums, drum fragments, uncontained soil and liquid wastes, wood, glass, paper, construction debris, and miscellaneous trash. Collectively, Sites G, H, I South, and L contain an estimated 637,000 cubic yards of soil and waste. The lower portion of the waste at these Sites is below the water table. Remedial investigation sampling at Sites G, H, I South, and L revealed PCB levels in the soil above 50 ppm. Specifically, soil samples taken from subsurface soil and waste showed PCB concentrations ranging from 13 ppm to 4,430 ppm at Site G, 0.25 ppm to 18,000 ppm at Site H, 20 ppm to 343 ppm at I South, and 16 ppm to 500 ppm at Site L.

In addition, as discussed above, there is residual DNAPL in the aquifer matrix underlying portions of Sites G, H, and I South. The dissolution of residual DNAPL in the aquifers beneath

[20] As discussed in Section 2.9.2, above , the crushed rock caps required under Alternative 5 are more appropriate for use with the PABS systems than impermeable RCRA Subtitle C designed caps because soil vapors will tend to accumulate in the waste and fill materials in the unsaturated zone beneath such an impermeable barrier.

[21] These PCB-contaminated soils and wastes contain PCBs as a result of a spill, release or unauthorized disposal which occurred prior to April 18, 1978, and thus are regulated for cleanup and disposal under 40 CFR Part 761.

[22] Sauget Area 1 Dead Creek Final Remedy Creek Bottom Soil Human Health Risk Assessment (ENSR Corporation, April 2006)

Sites G, H, and I South is an on-going source of contamination to downgradient groundwater. However, groundwater sampling results showed PCB concentrations ranging from non-detect to 0.2 ppm in the shallow hydraulic unit, non-detect to 8.0 $x10^{-4}$ ppm in the middle hydraulic unit, and non-detect to 12.0 $x10^{-3}$ ppm in the deep hydraulic unit. Overall, because PCBs are relatively insoluable in water, concentrations of PCBs in groundwater occur sporadically and at comparatively low concentrations both upgradient and downgradient of the disposal areas, throughout the aquifer. Therefore, groundwater is not significantly impacted by PCBs and PCB contaminated wastes are contained within the disposal areas.

Alternatives 3, 4, and 5 address the PCB and principal threat wastes that are present on the Site: the pooled DNAPL that is present at Site I South, and the subsurface soils contaminated with polychlorinated biphenyls (PCBs) and 2,3,7,8-TCDD-TEQ (dioxins) with risks above EPA's principal threat waste threshold of $1x10^{-3}$ in the utility corridor along Queeny Avenue, adjacent to Site H. Alternatives 3, 4, and 5 address these areas by treating the DNAPL recovered at Site I South through off-Site incineration and by relocating the utilities in the utility corridor to prevent unacceptable potential direct contact risk to utility workers during excavation/repair work.

Potential risks remaining at the Site related to PCB contamination is through potential direct contact to soils and waste contaminated with PCBs. To address or eliminate the direct contact exposure pathway, engineering controls[23] in the form of engineered covers are used in the Selected Remedy. Specifically, engineered covers meeting the requirements of 35 IAC § 724 will be installed over Sites G, H, I South, and L.

Under 40 CFR § 761.61(c), PCB remediation waste may be disposed of in a manner other than prescribed under Section 761.61(a) or (b), provided EPA determines that the method of disposal does not result in an unreasonable risk of injury to health or the environment. Alternatives 3, 4, and 5 include containment and treatment remedies. Specifically, the RCRA Subtitle C designed caps and 35 IAC § 724 compliant caps prevent or minimize human exposure, infiltration of water, and erosion in accordance with 40 C.F.R. § 761.61(a)(7). As discussed above, PCB concentrations in groundwater occur only sporadically and at comparatively low concentrations both upgradient and downgradient of the disposal areas, throughout the aquifer. In any case, impacted groundwater from Sauget Area 1 moves toward the west, toward the Mississippi River, which mostly naturally attenuates prior to reaching the River, and also most of the groundwater that does reach the River is captured and treated by the Sauget Area 2 Groundwater Migration Containment System.

The TSCA 40 CFR § 761.61(c) determination is included in Attachment E, and is based on EPA's finding that after the remedy selected in this ROD is implemented, the PCB-contaminated soils remaining on-Site will not pose an unreasonable risk of injury to health or the environment.

The ARARs that have been identified for the Selected Remedy in this ROD are listed in Appendix A.

[23] Engineering controls encompass a variety of engineered and constructed physical barriers (e.g., soil capping, sub-surface venting systems, mitigation barriers, fences) to contain and/or prevent exposure to contamination on a property.

2.10.3 - Long-term Effectiveness and Permanence

The evaluation of alternatives under this criterion addresses the results of a remedial action in terms of the risk remaining at the site after response objectives have been met. Alternatives 3, 4, and 5 are effective, permanent remedial alternatives that meet the RAOs for Sauget Area 1. Alternatives 3 and 4 provide a similar measure of long-term effectiveness and permanence after construction of the engineered covers is complete. Alternative 5 provides a higher degree of long-term effectiveness by reducing COC concentrations in the MHU and DHU underlying the source areas.

2.10.4 - Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the preference for selecting remedial actions that use treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible encapsulation, or reduction of total volume of contaminated media.

Alternative 3 includes off-Site incineration of the pooled DNAPL recovered from Site I South, which is treatment to reduce the toxicity, mobility, and volume of this principal threat material.

Alternative 4 includes off-Site incineration of the pooled DNAPL recovered from Site I South, plus the capture and treatment of leachate. The additional treatment brought about by the leachate control component of Alternative 4 provides a relatively limited reduction in mobility and volume of COCs in the fill areas at Sites G, H, and I South, as discussed in Section 2.5.5.

Alternative 5 includes off-Site incineration of the pooled DNAPL recovered from Site I South, plus extensive in-situ aerobic biodegradation of COCs in areas of Sites G, H, and I South using PABS systems targeting the residual DNAPL areas in the MHU and DHU. Alternative 5 provides a significantly higher degree of treatment compared to Alternatives 3 and 4. As much as 230,000 kg of contaminants would be treated under Alternative 5.

2.10.5 - Short-term Effectiveness

This criterion examines the effectiveness of the alternatives in protecting human health and the environment during implementation of the cleanup until the cleanup is complete. It considers protection of the community, workers, and the environment during the cleanup.

Short-term risks associated with implementation of Alternative 3, 4, and 5 are typical of a construction project that involves construction of engineered covers. These risks include general risks to construction workers as well as risks to the community due to significant truck traffic needed to bring the large volume of fill and cover material to Sites G, H, I South, and L. Other risks include the potential for dust emissions or storm-water runoff from areas of affected soils or waste during construction of the cover.

The potential risks to the community due to dust emissions and storm-water runoff can be managed through fugitive dust and stormwater control measures that will be developed during remedial design. The potential risks to Site workers during remedy implementation can be managed by requiring adequate personal protection equipment (PPE) and routine safety procedures that will be specified in a health and safety plan to be developed during remedial design.

2.10.6 - Implementability

This criterion assesses the technical and administrative feasibility of an alternative and the availability of required goods and services. Technical feasibility considers the ability to construct and operate a technology and its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. Administrative feasibility considers the ability to obtain approvals from other parties or agencies and the extent of required coordination with other parties or agencies.

Alternative 3 would be readily implementable at Sites G, H, I South, and L. However, construction of a RCRA Subtitle C cap at Site I South would be difficult to implement and would be disruptive to current operations. Site I South is located at an active industrial facility. Site I South is used for truck trailer parking and has two roads; a rail spur; truck scales; and a guard shack within its boundary (Figure 6). In addition, the eastern side of the facility's employee parking lot is located within the boundary of Site I South. Installation of a RCRA Subtitle C cap at Site I South would significantly change the topography of the site and would likely result in a reduction of the usable area of the site available for truck trailer parking.

Alternative 4 would be readily implementable at Sites G, H, I South, and L. At Site I South, however, the construction of a RCRA Subtitle C cap and installation of an extensive grid of leachate recovery wells would be difficult to implement and would be disruptive to current operations.

Alternative 5 would be readily implementable at Sites G, H, I South and L. However, implementation of the PABS component involves installation of underground piping. The PABS system would require a network of underground piping to deliver compressed air to the sparge wells and to route recovered vapors from the passive vapor wells to centrally located equipment compounds. The excavation activities would be disruptive to current operations at Site I South.

2.10.7 - Cost

This criterion evaluates the capital and operation and maintenance costs of each alternative. Present-worth costs are presented to help compare costs among alternatives with different implementation times.

The present worth costs for the alternatives are presented within the descriptions of alternatives in Section 2.9.2 of this ROD. The information in the cost estimate summary is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the

cost elements are likely to occur as a result of new information and data collected during the remedial design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences (ESD), or a ROD amendment. The detailed cost estimates and associated assumptions for all alternatives are in the FS within the Administrative Record. The estimates are within a range of accuracy of +50 to -30 percent.

Alternative 1 has no associated capital or O&M costs since no action would be taken. Alternatives 2, 3, and 4 alternatives are progressively more expensive. Alternative 2 is the least costly action alternative ($3.1 million) and Alternative 3 is the next least costly option ($12.8 million). Alternative 4 is the most costly alternative ($22.5), costing just less than twice as much as Alternative 3. Alternative 5 costs less than Alternative 4, but provides a significantly higher degree of treatment compared to Alternatives 3 and 4. As much as 230,000 kg of contaminants would be treated under Alternative 5.

2.10.8 - State/Support Agency Acceptance and Community Acceptance

State/support agency acceptance considers the state's preferences among or concerns about the alternatives, including comments on regulatory criteria or proposed use of waivers. Community acceptance considers the community's preferences or concerns about the alternatives.

The State of Illinois has indicated support for the selection of Alternative 5 as the Selected Remedy. The State's concurrence letter will be added to the Administrative Record upon receipt.

During the public comment period, the community expressed general support for Alternative 5. A complete list of the public comments and EPA's response to the comments is contained in the *Responsiveness Summary*, which is Part 3 of this ROD. In addition, the transcript from the proposed plan public meeting is included in the administrative record.

2.10.9 – Comparative Analysis Summary

Table 27 provides a summary of the comparative analysis of the alternatives described in Sections 2.10.1 through 2.10.8 above.

Table 27 – Comparison of Cleanup Options with the Nine Superfund Remedy Selection Criteria					
Evaluation Criterion	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5***
1. Overall Protection of Human Health and the Environment	○	○	●	●	●
2. Compliance with ARARs	○	◉	●	●	●
3. Long-term Effectiveness and Permanence	○	◉	●	●	●
4. Reduction of Toxicity, Mobility, or Volume through Treatment	○	○	○	◉	◉
5. Short-term Effectiveness	N/A**	●	●	●	●
6. Implementability	N/A**	●	●	●	●
7. Cost ($ millions)	$0	$3.1	$12.8	$22.5	$14.8
8. State Acceptance	The State supports the preferred alternative (Alternative 5).				
9. Community Acceptance	The community supports the preferred alternative (Alternative 5).				
● Fully meets criterion ◉ Partially meets criterion ○ Does not meet criterion					
* EPA's preferred alternative					
**N/A: not applicable, since no remedy is being implemented in the No-Action Alternative					

2.11 – Principal Threat Waste

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site, wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or will present a significant risk to human health or the environment should exposure occur. Conversely, low-level threat wastes are those source materials that generally can be reliably contained and that will present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

Wastes generally considered principal threats include but are not limited to the following:

- **Liquid source material** - wastes contained in drums, lagoons or tanks, or free product in the subsurface (i.e., non-aqueous phase liquids) containing contaminants of concern (generally excluding groundwater).

• **Mobile source material** - surface soil or subsurface soil containing high concentrations of chemicals of concern that are (or potentially are) mobile due to wind entrainment, volatilization (e.g., volatile organic compounds), surface runoff, or subsurface transport.

• **Highly toxic source material** - buried, drummed non-liquid wastes; buried tanks containing non-liquid wastes; or soils containing significant concentrations of highly toxic materials.

Wastes that generally will not constitute principal threats include but are not limited to the following:

• **Non-mobile contaminated source material of low to moderate toxicity** - surface soil containing chemicals of concern that generally are relatively immobile in air or groundwater (i.e., non-liquid, low volatility, low leachability contaminants such as high molecular weight compounds) in the specific environmental setting.

• **Low toxicity source material** - soil and subsurface soil concentrations not greatly above reference dose levels or that present an excess cancer risk near the acceptable risk range if exposure were to occur.

To protect human health and the environment, a combination of methods would be used to address principal threat wastes and low-level threat wastes in Alternatives 3, 4, and 5. Principal threat wastes have been identified in the pooled DNAPL that is present at Site I South and in subsurface soils in the utility corridor adjacent to Site H and south of Queeny Avenue contaminated with PCBs and 2,3,7,8-TCDD-TEQ with risks above EPA's principal threat waste threshold of $1x10^{-3}$. Alternatives 3, 4, and 5 address these areas by treating the pooled DNAPL recovered by Site I South by off-Site incineration, and by relocating the utilities in the utility corridor to prevent unacceptable risk to utility workers during excavation work.

Although residual DNAPL is not itself a mobile source material; therefore not classified as a principal threat waste, it is considered to be a significant source of on-going contamination to groundwater at the Site. The DNAPL characterization and remediation study estimated the total volume of fill and aquifer matrix at Sites G, H, and I South affected by residual DNAPL is approximately 1,200,000 cubic yards. Alternative 5 will address this significant source of on-going contamination through extensive in-situ aerobic biodegradation of COCs in areas of Sites G, H, and I South using the PABS systems targeting the residual DNAPL areas in the MHU and DHU. As much as 230,000 kg of contaminants would be treated under Alternative 5.

To address the remaining low-level threat waste and to eliminate the direct contact exposure pathway, engineering controls will be used. Engineered covers meeting the requirements of 35 IAC § 724 compliant caps will be installed over Sites G, H, I South, and L.

2.12 – Selected Remedy

The Selected Remedy for OU1 of the Sauget Area 1 Site is Remedial Alternative 5:

- Recovery of Pooled DNAPL at Site I South;

- Pulsed Air Biosparging at Residual DNAPL Areas at Sites G, H, and I South;
- 35 IAC § 724 Compliant Soil or Crushed Rock Caps at Sites G, H, I South, and L;
- Asphalt Pavement Cap at Site G West;
- Utility Relocation in utility corridor adjacent to Site H, south of Queeny Avenue;
- Containment Cell O&M;
- Monitoring Well Network;
- Institutional and Access Controls: Sites G, H, I South, and L; and
- No Further Action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N

If the pilot study concludes PABS is not feasible, the contingent remedy will be Alternative 3.

Summary of the Rationale for the Selected Remedy

The Selected Alternative, Alternative 5, was selected over other alternatives because it is expected to achieve substantial and long-term risk reduction through treatment, it is expected to prevent future exposure to currently contaminated soils and groundwater, and it is expected to allow the property to be used for the reasonably anticipated future land use, which is industrial.

The Selected Remedy will address the significant sources of on-going contamination to groundwater through extensive in-situ aerobic biodegradation of COCs in areas of Sites G, H, and I South using PABS systems targeting the residual DNAPL areas in the MHU and DHU. As much as 230,000 kg of contaminants would be treated under Alternative 5.

Based on the information available at this time, EPA and the State of Illinois believe the Selected Remedy will be: (1) protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, and (4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Because it will treat the source materials that are a significant source of on-going groundwater contamination, the remedy also meets the statutory preference for the selection of a remedy that involves treatment as a principal element. If the pilot study concludes PABS is not feasible, the contingent remedy will be Alternative 3.

Description of Protectiveness Achieved by the Selected Remedy

The Selected Remedy, Alternative 5, achieves protectiveness by off-Site incineration of the pooled DNAPL recovered from Site I South, plus extensive in-situ aerobic biodegradation of COCs in areas of Sites G, H, and I South using PABS systems targeting the residual DNAPL areas in the MHU and DHU. The Selected Remedy provides a significantly higher degree of treatment compared to Alternatives 2, 3, and 4. As much as 230,000 kg of contaminants would be treated through implementation of the selected remedy. Engineering controls will be used to address the remaining low-level threat waste by eliminating the direct contact exposure pathway. Engineered covers meeting the requirements of 35 IAC § 724 compliant caps will be installed over Sites G, H, I South, and L.

Summary of the Estimated Remedy Costs

The estimated cost of implementing the Selected Remedy, Alternative 5, at OU1 is $14.8 million. A detailed cost estimate for Alternative 5 is included as Appendix B. The cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data that will be collected during the remedial design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Expected Outcome of the Selected Remedy

The expected outcome of the Selected Remedy, Alternative 5, is that receptors in Sauget Area 1 Sites will no longer be exposed to soil or groundwater source areas that pose a threat to human health or the environment. Additionally, the Selected Remedy will reduce the contaminant mass flux in groundwater through treatment. The land use of the properties within the Site will remain unchanged.

2.13 – Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment

Implementation of the Selected Remedy, Alternative 5, will be protective of human health and the environment through the removal of pooled DNAPLs beneath Site I South, by treating residual DNAPLs beneath Sites G, H, and I South through extensive in-situ aerobic biodegradation of COCs present there using PABS systems targeting the residual DNAPL areas in the MHU and the DHU, and by eliminating direct contact exposure pathway through installation of 35 IAC § 724 compliant soil or crushed rock caps at Sites G, H, I South, and L; and asphalt pavement cap at Site G West.

The Site-specific RAOs were developed to protect current and future receptors that are potentially at risk from exposure to the soil and groundwater source contaminants at OU1. The Selected Remedy will achieve the RAOs. Institutional and access controls will be employed at Sites G, H, I South, and L in order to ensure that the remedy remains protective.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that Superfund remedial actions meet ARARs. Appendix A provides a list of all ARARs that have been identified for the remedial action. The Selected Remedy will comply with the identified ARARs.

Cost-Effectiveness

EPA has concluded that the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (NCP Section 300.430(f)(1)(ii)(D)). This determination was made by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the Selected Remedy was determined to be proportional to its costs. The Selected Remedy therefore represents a reasonable value for the money to be spent.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the Selected Remedy, Alternative 5, represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site disposal, and considering state and community acceptance. Alternative 5 includes off-Site incineration of the pooled DNAPL recovered from Site I South, plus extensive in-situ aerobic biodegradation of COCs in areas of Sites G, H, and I South using PABS systems targeting the residual DNAPL areas in the MHU and DHU. The Selected Remedy provides a significantly higher degree of treatment compared to Alternatives 2, 3, and 4. As much as 230,000 kg of contaminants would be treated through implementation of the selected remedy. To address the remaining low-level threat waste and to eliminate the direct contact exposure pathway, engineering controls will be used. Specifically, engineered covers meeting the requirements of 35 IAC § 724 compliant caps will be installed over Sites G, H, I South, and L.

The Selected Remedy therefore provides a permanent solution for both principal threat waste and the low-level wastes at OU1 that is effective in the long term and achieves significant reductions in contaminant mass flux to groundwater through treatment of DNAPL residuals.

Preference for Treatment as a Principal Element

The Selected Remedy, Alternative 5, will treat DNAPLs through off-Site incineration of the pooled DNAPL recovered from Site I South and extensive in-situ aerobic biodegradation of COCs in areas of Sites G, H, and I South using PABS systems targeting the residual DNAPL areas in the MHU and DHU. The Selected Remedy provides a significantly higher degree of treatment compared to Alternatives 2, 3, and 4. As much as 230,000 kg of contaminants would be treated through implementation of the selected remedy. By utilizing treatment as a portion of the remedy, the Selected Remedy satisfies the statutory preference for remedies that employ treatment as a principal element to the maximum extent practicable.

Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site, at depth but above levels that allow for unlimited use and unrestricted exposure, EPA will conduct a statutory review within five years after initiation of the remedial action and every five years subsequent, to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 – Documentation of Significant Changes

EPA released the Proposed Plan for OU1 for public comment on February 20, 2013. The Proposed Plan identified as the preferred alternative was Remedial Alternative 5, which, consistent with this ROD, proposed pooled DNAPL recovery at Site I South; pulsed air biosparging (PABS) at residual DNAPL areas at Sites G, H, and I South; 35 IAC § 724 compliant soil or crushed rock caps at Sites G, H, I South and L; asphalt pavement caps at Site G West; Containment Cell operation and maintenance; monitoring well network; utility relocation; and institutional and access controls at Sites G, H, I South, and L. The Plan also noticed the public that should the pilot study conclude that PABS is not feasible, the contingent remedy would be Alternative 3.

After carefully reviewing all written and verbal comments submitted during the public comment period, EPA has determined that no significant changes to the remedy as originally identified in the Proposed Plan are necessary or appropriate.

Part 3 – Responsiveness Summary

The Proposed Plan for the Sauget Area 1 Site was released for public comment on February 20, 2013. EPA held a public meeting in Cahokia, Illinois on March 5, 2013, to describe the Proposed Plan and answer questions about the different cleanup alternatives. The public meeting also provided the community with an opportunity to comment on the proposed cleanup alternative and the other alternatives evaluated. EPA received several general comments and a few technical comments at the public meeting. These comments and responses are provided below.

3.1 – Stakeholder Comments and Lead Agency Responses

Comment: A commenter requested that questions and answers from the question and answer period be part of the official record.

> **Response**: A transcript of the questions posed during the presentation of information along with the answers given is included in the EPA's file and is part of the Administrative Record for the Sauget Area 1 Site.

Comment: A commenter stated concern over a possible levee breach resulting in a major flood, as well commenting that the levee project is grossly underestimated at the 100-year flood and does not account for climate change and higher river levels due to flood plain development. The commenter asked if EPA had an alternative that includes removal of the contaminants from the flood plain.

> **Response**: Alternatives that remove all soil and wastes with contamination were not considered technically feasible as a result of the excessive excavation depths (about 100 feet), water handling issues (the contaminated soil is below the groundwater table) and risks to workers and the community from such a massive excavation project.

Comment: A commenter asked about the timing of the groundwater proposed plan.

> **Response:** The groundwater operable unit proposed plan is currently scheduled to be presented to the public after the soil and groundwater source remedies for Sauget Area 1 and Sauget Area 2 have been implemented.

Comment: A commenter noted that the exposure assessment should include subsistence fishers, as well as hikers, and wildlife and nature observers in the risk assessment.

> **Response:** Potential exposures by hikers and wildlife and nature observers can be represented by the potential exposures that were evaluated in the OU1 and OU2 risk assessments for trespassing teenagers (ages 7-18), recreational anglers, recreational teenagers (ages 7-18), and recreational children (ages 0-6) since the media to which they may be exposed and the frequency of exposure are expected to be similar. The HHRA for Sauget Area 1 evaluated potential exposures by these receptors to various environmental media, as indicated below:
>
> - Surface soil at each site (Sites G, H, I, L, and N) – contact by trespassing teenagers at a frequency of 26 days/year for 11 years.
> - Fish in Borrow Pit Lake – ingestion of approximately 6 pounds of fish per year by recreational anglers for 365 days/year for 30 years, assuming that 0.3 ounces of fish are eaten per day (i.e., 6.8 pounds/ year) from the lake.
> - Bottom soil in Dead Creek – contact by recreational teenagers during wading for 26 days/year for 11 years, and recreational children during wading for 26 days/year for 6 years).
> - Sediment in Borrow Pit Lake – contact by recreational teenagers during wading or swimming for 26 days/year for 11 years, and recreational adult anglers during wading for 22 days/year for 30 years.

- Surface water in Borrow Pit Lake and Dead Creek - contact by recreational teenagers and anglers, but detected chemicals did not exceed screening levels.

Currently, subsistence anglers are not known to be present in the vicinity of the Site. Due to the industrial nature of the area surrounding the Site, subsistence anglers are not expected to be present in the Site vicinity in the foreseeable future. Therefore, subsistence fishing is not a reasonably foreseeable scenario and was not included in the HHRA.

Comment: A commenter wanted to see a good description of how the contaminant plume or plumes and three dimensions have been located and characterized.

Response: The Remedial Investigation Report for the Sauget Area 1 Site included numerous figures presenting the groundwater contaminant plumes in plan-view and cross-section. The Remedial Investigation Report is available in the Cahokia Public Library as well as the EPA website listed in the Proposed Plan for the Sauget Area One Site.

Comment: A commenter asked the following questions: if more barrier walls, like the one at Sauget Area 2, Site R, should be installed; if more frequent groundwater sampling is needed; if EPA would provide split samples and oversight of PRP sampling; if more wells north of the Site are needed because of the IDOT pumping; and the location to where DNAPLs pumped from the Site go to for incineration.

Response: The slurry wall, along with groundwater extraction system that minimizes migration of contamination to the river, was installed around Site R as part of the interim groundwater remedy at Sauget Area 2. Site R has by far caused the greatest amount of groundwater contamination and is adjacent to the River. The GMCS system also captures groundwater contamination migrating from the Krummrich facility, the former Clayton Chemical facility site, the other Area 2 sites, and some of the Area 1 sites. Additional slurry wall systems were not considered for the Area 1 Site because: 1) the contamination from Area 1 is naturally attenuating substantially and not reaching and therefore not affecting the River, and 2) a significant portion of the groundwater contaminant plume from Area 1 that does reach the River is captured and treated by the GMCS system.

More frequent groundwater sampling is not needed because groundwater moves very slowly in the subsurface and the frequency of sampling currently planned will be able to detect changes prior to risks occurring. EPA's plan is to quickly finalize a settlement whereby the cleanup and associated sampling will be performed by the potentially responsible parties (PRPs) who signed a stipulation of their liability in the course of a prior EPA cost recovery action. EPA will continue to provide oversight of all PRP work and will obtain split samples as needed during future investigations and regular monitoring activities. The addition of monitoring wells north of the Site to monitor the effect of IDOT pumping will be considered in the design of the selected remedy for the groundwater operable unit.

The DNAPL pumped from Site I South is currently incinerated at Clean Harbors Deer Park facility located in La Porte, Texas. DNAPL will continue to be disposed only at permitted hazardous waste treatment and disposal facilities that have been approved by EPA and which are in compliance with all environmental laws.

Comment: A commenter asked if union members would be given a chance to work on the project.

Response: The hiring of local labor is at the discretion of the implementing party.

Comment: A commenter stated appreciation to EPA for having the public hearing and asked if the levee districts get involved and bring up contaminants whether they would be a potential PRP.

Response: EPA appreciates the thanks and will continue to inform the public as we move through design and construction of the selected remedy. Liability determinations are made under Section 107 of CERCLA and it is EPA policy to have responsible parties implement or pay for cleanups under the law.

FIGURES

Figure 1: Sauget Area 1

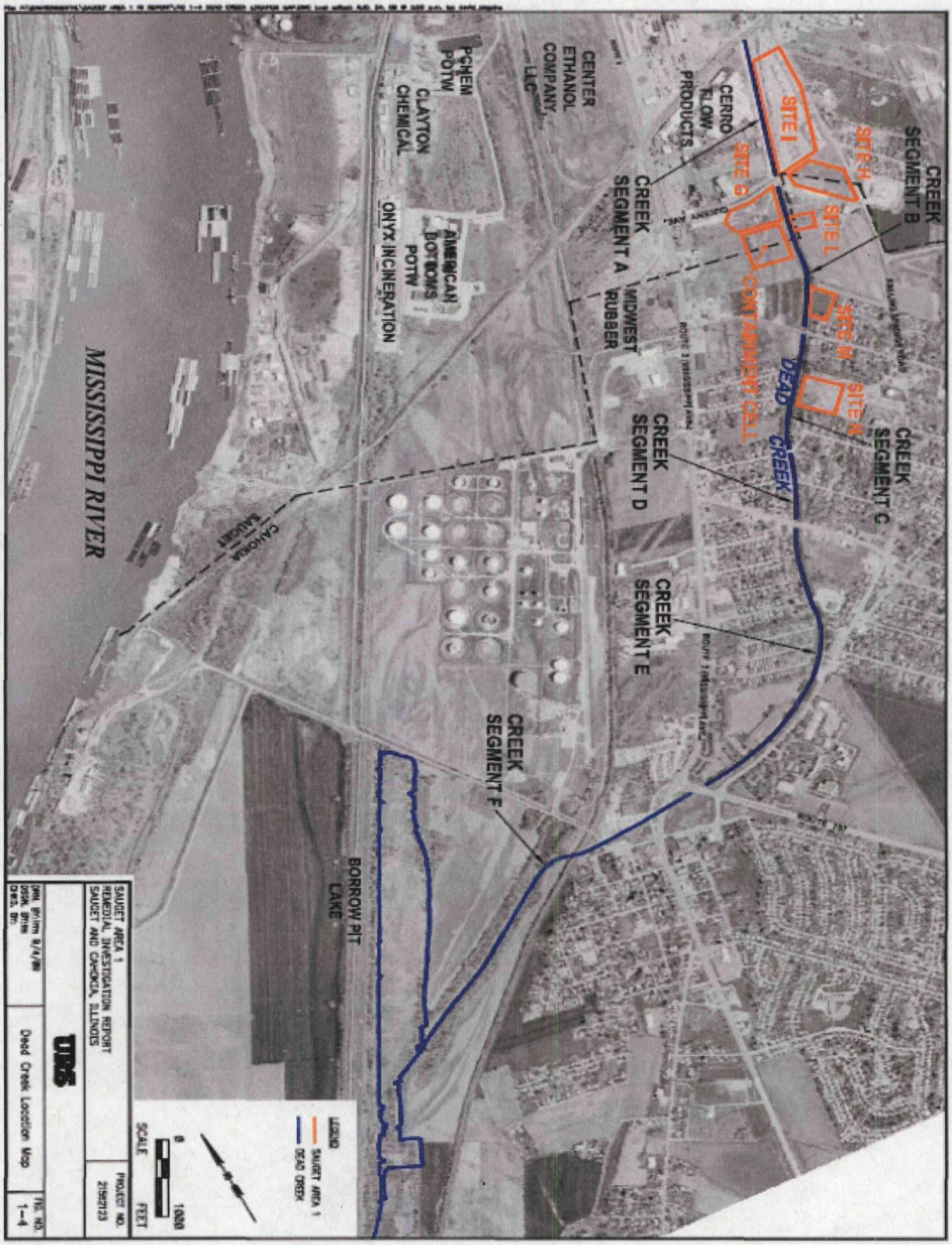


Figure 2: Conceptual Site Model

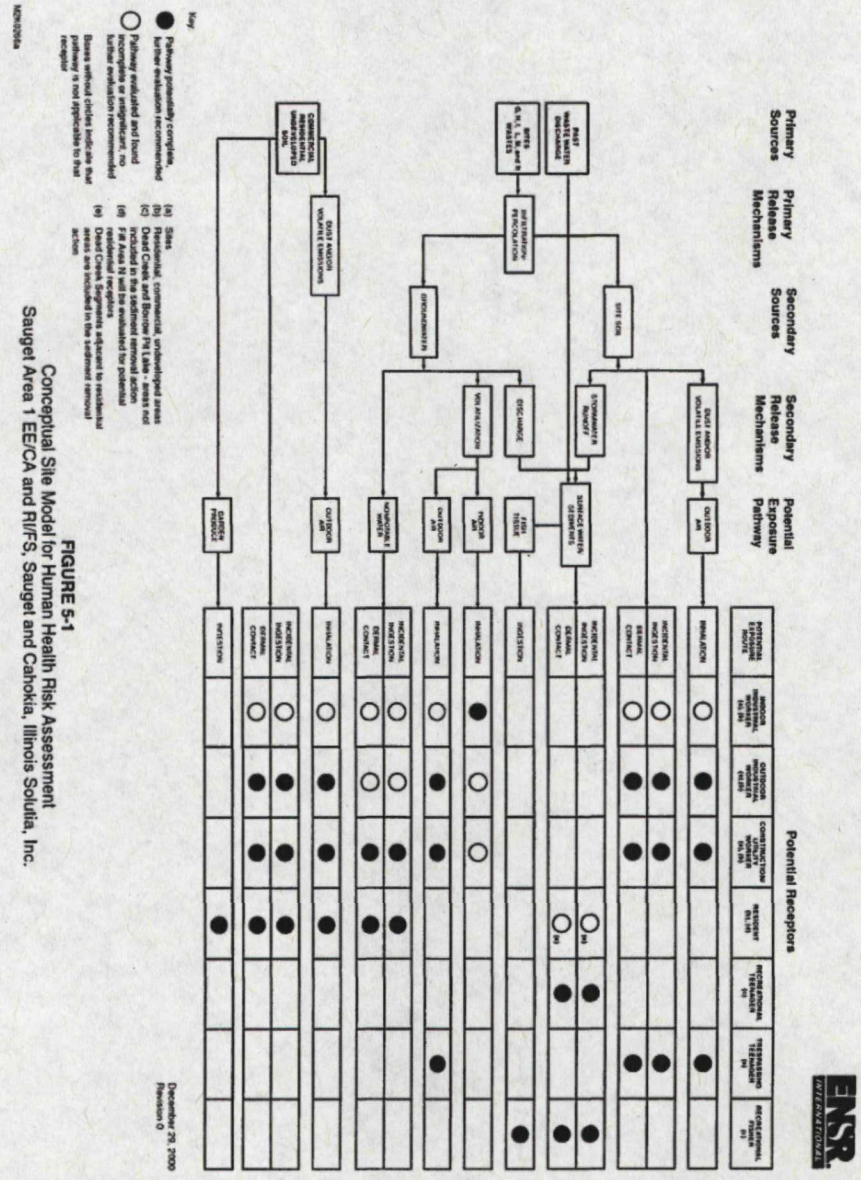


FIGURE 5-1
Conceptual Site Model for Human Health Risk Assessment
Sauget Area 1 EE/CA and RI/FS, Sauget and Cahokia, Illinois Solutia, Inc.

Figure 3: Generalized Geologic Cross Section

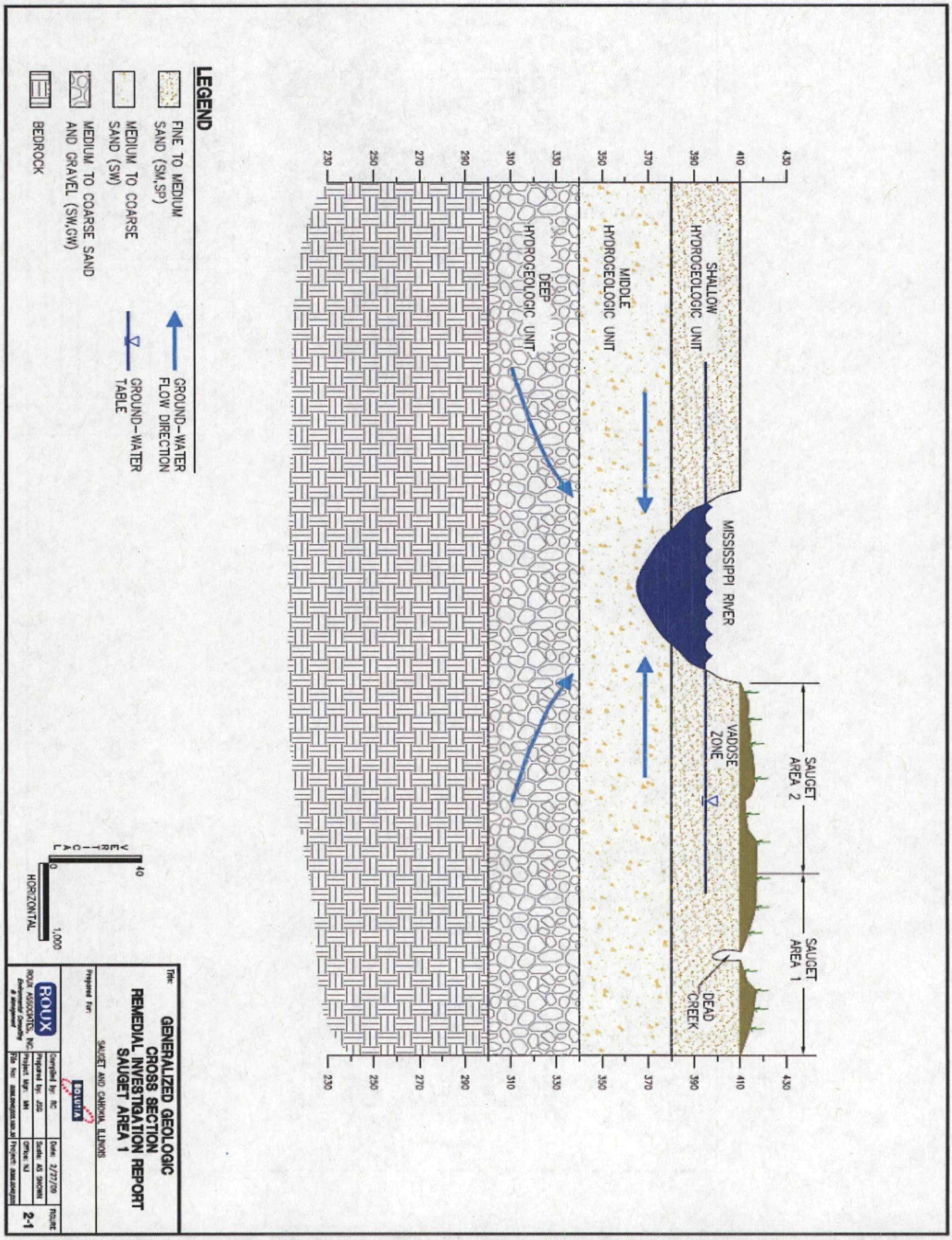


Figure 4: Contaminant Mass Flux Conceptual Site Model Cross-Section

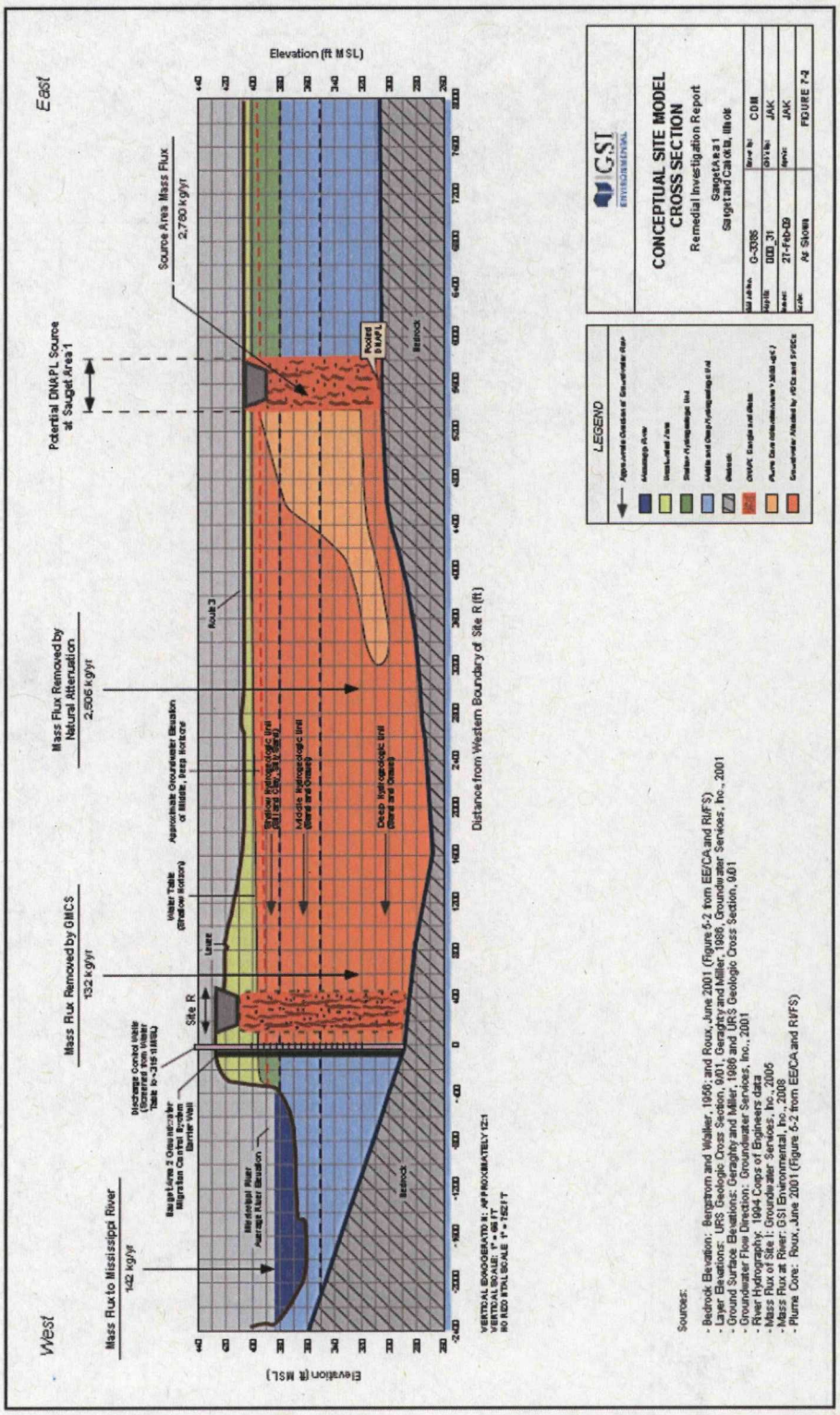


Figure 5: Conceptual Cap Areas at Sites G, H, and L

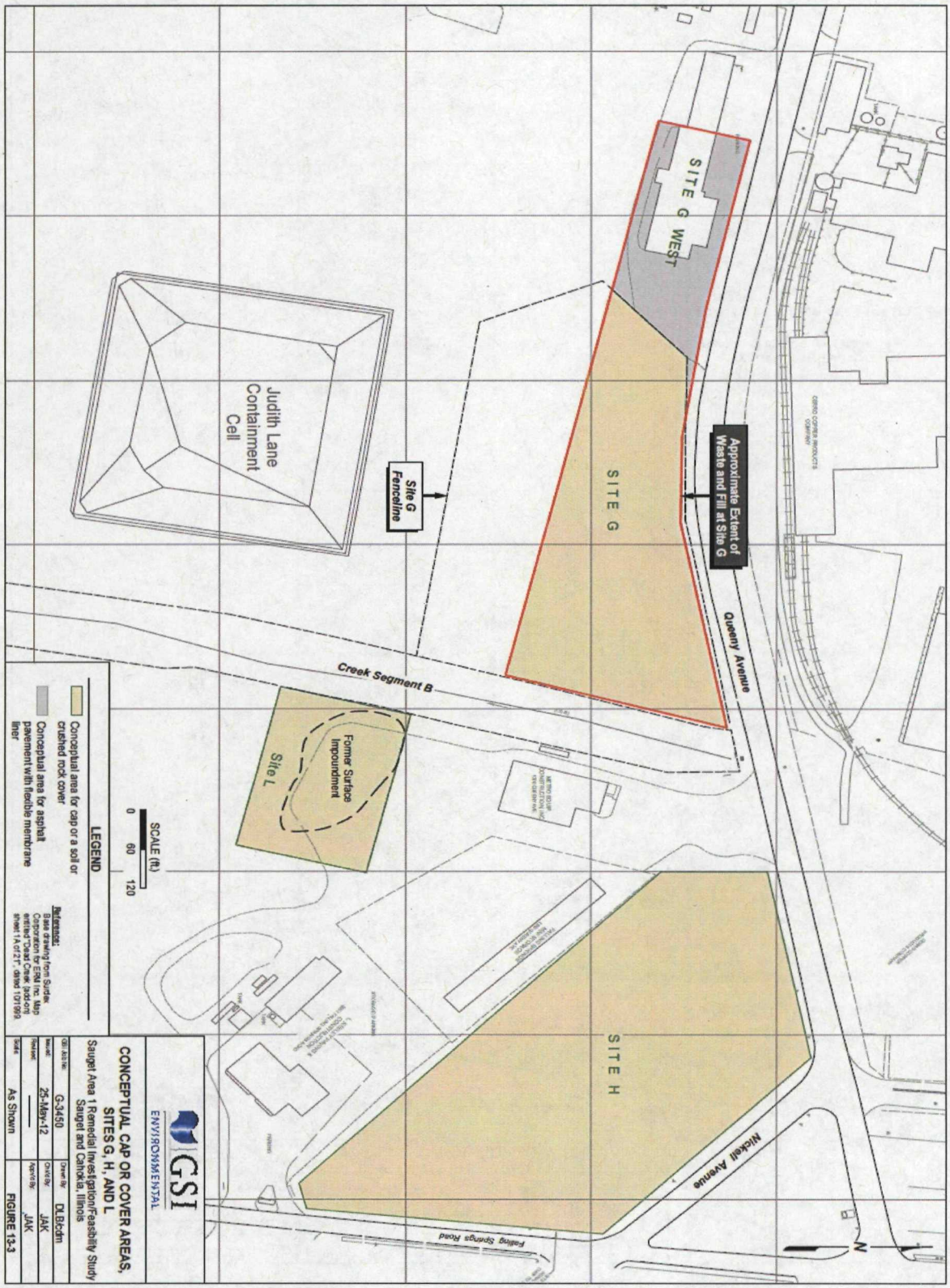


Figure 6: Conceptual Cap Area at Site I South

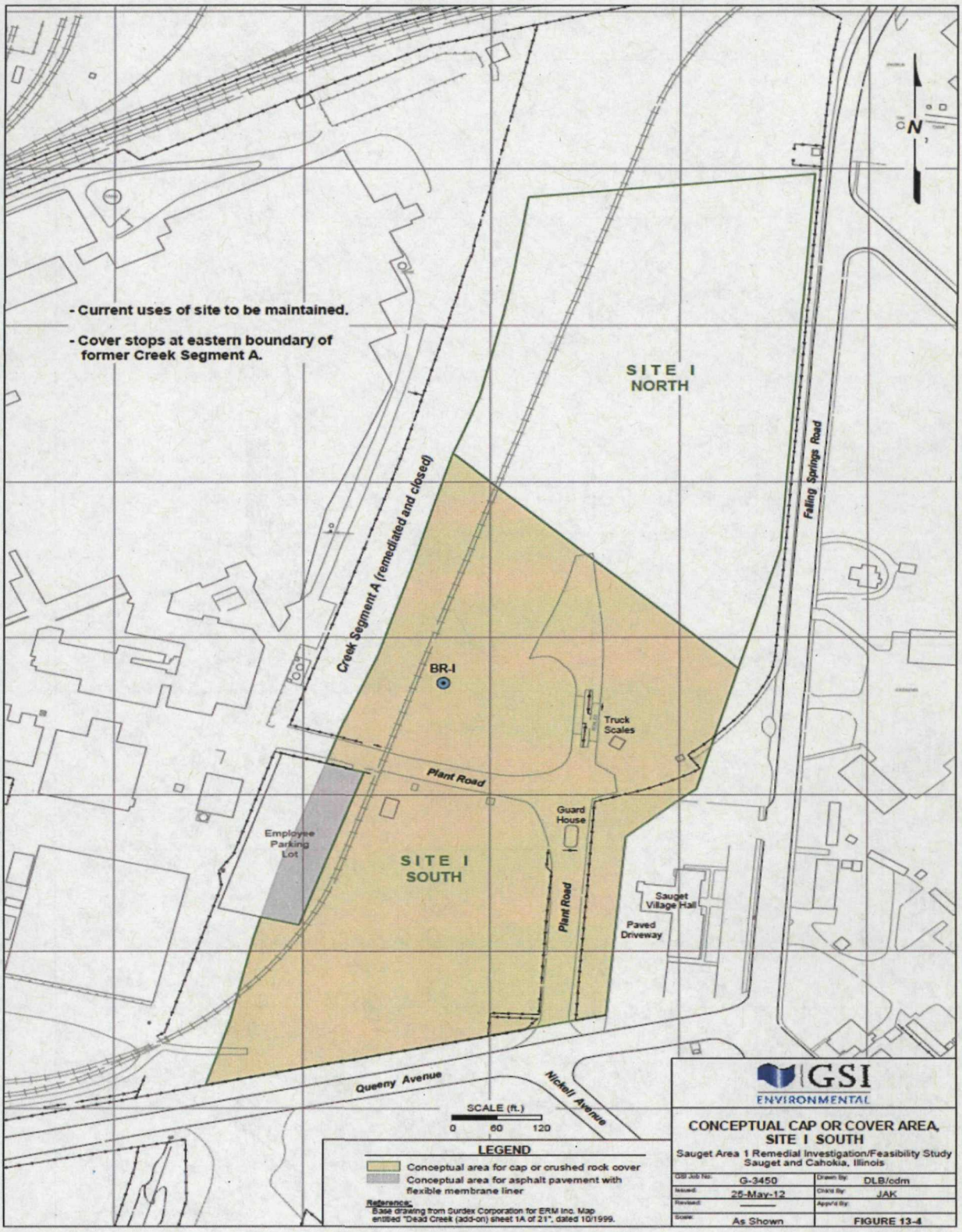


Figure 7: Conceptual Biosparge Well Locations

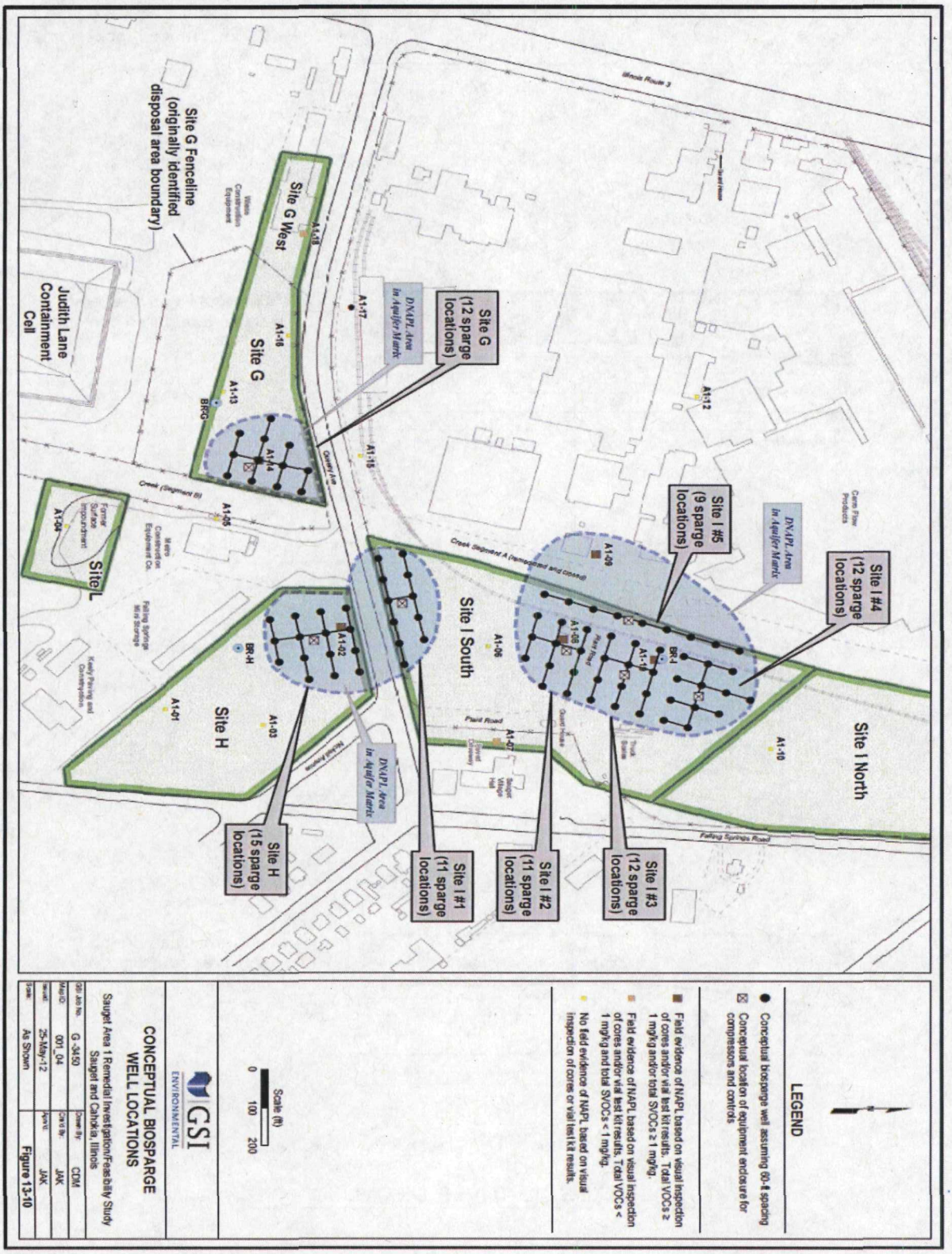
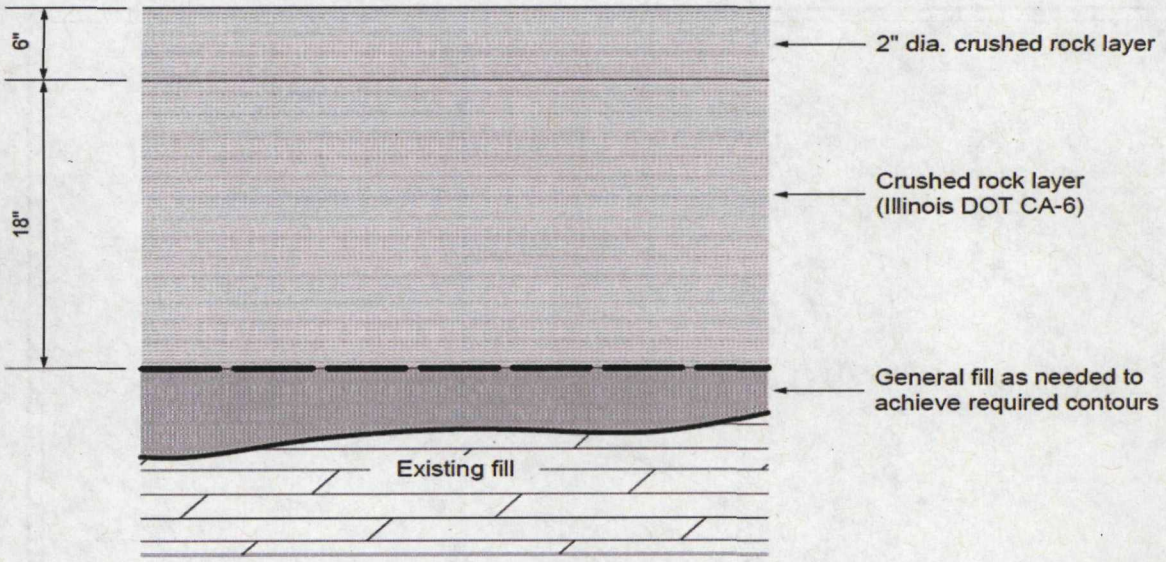
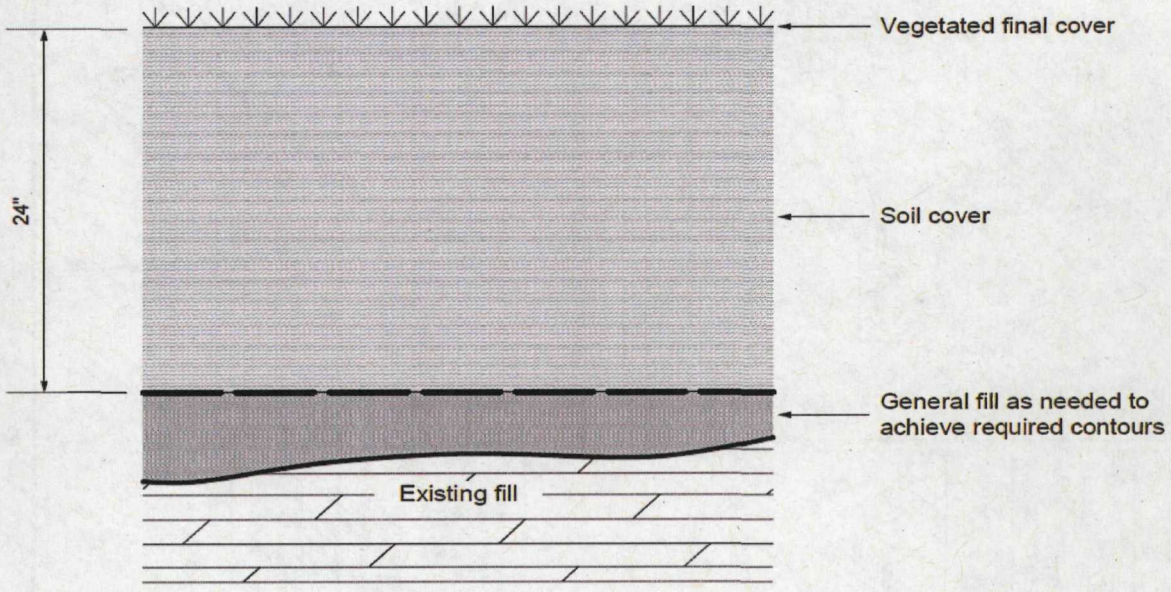


Figure 8: Crushed Rock and Soil Cap Detail



TYPICAL CRUSHED ROCK COVER DETAIL

Not to Scale



TYPICAL SOIL COVER DETAIL

Not to Scale

APPENDIX A

LIST OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Sauget Area 1 Site
Applicable or Relevant and Appropriate (ARARs)
Table

ARAR	Description of Requirements	Classification
35 IAC 620.405 (Illinois Groundwater Quality Standards)	Prohibits any person from causing, threatening, or allowing release of contaminants to groundwater resulting in exceedence of groundwater quality standards.	Applicable
35 IAC 620.410 (Illinois Groundwater Quality Standards)	Class 1 groundwater standards (in general equivalent to a drinking water standard or the MCL).	Applicable
35 IAC 620.250 (Illinois Groundwater Quality Standards)	A groundwater management zone (GMZ) may be established for a three dimensional region containing groundwater being managed to mitigate impairment caused by the release of contaminants from a site: (1) That is subject to a corrective action process approved by the Agency; or (2) For which the owner or operator undertakes an adequate corrective action in a timely and appropriate manner. The GMZ suspends the groundwater quality standards during the period of remediation until the groundwater quality standards have been attained.	Applicable
35 IAC 620.260 (Illinois Groundwater Quality Standards)	Any person may petition the Illinois Pollution Control Board to reclassify a groundwater in accordance with the procedures for adjusted standards specified in Section 28.1 of the Act and 35 Ill. Adm. Code 106, Subpart G. In any proceeding to reclassify specific groundwater by adjusted standard, in addition to the requirements of 35 Ill. Adm. Code 106, Subpart G, and Section 28.1(c) of the Act, the petition shall, at a minimum, contain information specified in this section.	Applicable
35 IAC 302.208 (Illinois Surface Water Quality Standards)	Numeric Surface Water Quality Standards are established for the protection of human health and aquatic life. The Mississippi River is not provided any specific surface water designation; therefore, the general use water quality standards would be applied. The general use water quality standards provide criteria for the protection of aquatic life (acute and chronic) and human health.	Applicable
35 IAC 302.210 (Illinois Surface Water Quality Standards)	Waters of the State shall be free from any substances or combination of substances in concentrations toxic or harmful to human health, or to animal, plant or aquatic life. This regulation includes those constituents without a promulgated standard in 35 IAC 302.208. These derived water quality criteria may be found on IEPA's web site (http://www.epa.state.il.us/water /water-quality-standards/water-quality-criteria.html) and will include any additional criteria that IEPA develops to address specific chemicals associated with the Sauget Area 1 Sites for which derived criteria have not been calculated already.	Applicable
35 IAC 301.108 (Illinois Water Quality and Pollution Control regulations general provisions)	The Illinois Pollution Control Board may grant an adjusted standard to an applicable regulatory standard for persons who can justify such an adjustment consistent with subsection (a) of section 27 of the Illinois Environmental Protection Act.	Applicable

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.191 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.91)	Required Programs: Owners and operators subject to Subpart F must conduct a monitoring and response program as follows: 1) Whenever hazardous constituents pursuant to Section 724.193 from a regulated unit are detected at a compliance point pursuant to Section 724.195, the owner or operator must institute a compliance monitoring program pursuant to Section 724.199. 2) Whenever the groundwater protection standard pursuant to Section 724.192 is exceeded, the owner or operator must institute a corrective action program pursuant to Section 724.200. 3) Whenever hazardous constituents pursuant to Section 724.193 from a regulated unit exceed concentration limits pursuant to Section 724.194 in groundwater between the compliance point pursuant to Section 724.195 and the downgradient facility property boundary, the owner or operator must institute a corrective action program pursuant to Section 724.200	Relevant and Appropriate
35 IAC 724.192 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.92)	Groundwater Protection Standard: The owner or operator must ensure that hazardous constituents under Section 724.193 detected in the groundwater from a regulated unit do not exceed the concentration limits under Section 724.194 in the uppermost aquifer underlying the waste management area beyond the point of compliance under Section 724.195 during the compliance period under Section 724.196.	Relevant and Appropriate
35 IAC 724.193 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.93)	Hazardous Constituents: The Agency must specify in the facility permit the hazardous constituents to which the groundwater protection standard of Section 724.192 applies. Hazardous constituents are constituents identified in Appendix H of 35 Ill. Adm. Code 721 that have been detected in groundwater in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless the Agency has excluded them under subsection (b) of this Section.	Relevant and Appropriate
35 IAC 724.194 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.94)	Concentration Limits: The Agency must specify in the facility permit concentration limits in the groundwater for hazardous constituents established under Section 724.193. The following must be true of the concentration of a hazardous constituent: 1) It must not exceed the background level of that constituent in the groundwater at the time that limit is specified in the permit; or, 2) For any of the constituents listed in Table 1, it must not exceed the respective value given in that Table if the background level of the constituent is below the value given in Table 1; or, 3) It must not exceed an alternative limit established by the Agency under subsection (b) of this Section.	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.195 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.95)	Point of Compliance: The Agency must specify in the facility permit the point of compliance at which the groundwater protection standard of Section 724.192 applies and at which monitoring must be conducted. The point of compliance is a vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units.	Relevant and Appropriate
35 IAC 724.196 a) (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.96 (a))	Compliance Period: The Agency must specify in the facility permit the compliance period during which the groundwater protection standard of Section 724.192 applies. The compliance period is the number of years equal to the active life of the waste management area (including any waste management activity prior to permitting, and the closure period.)	Relevant and Appropriate
35 IAC 724.197 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.97)	724.197(a) - The groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that fulfill the following requirements: 1) They represent the quality of background water, 2) They represent the quality of groundwater passing the point of compliance; and, 3) They allow for the detection of hazardous waste or hazardous constituents that have migrated to the uppermost aquifer. 724.197(c) - All monitoring wells must be cased in accordance with this section. 724.197(d) - The groundwater monitoring program must include consistent sampling and analysis to ensure a reliable indication of groundwater quality below the waste management area. The program must include procedures and techniques for the following: 1) Sample collection; 2) Sample preservation and shipment; 3) Analytical procedures; and 4) Chain of custody control. 724.197(e) - The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents in groundwater samples. 724.197(f) - The groundwater monitoring program must include a determination of the groundwater surface elevation each time groundwater is sampled. 724.197 (h) and (i) - Specifies the statistical methods that may be used in evaluating groundwater monitoring data and performance standards for each statistical method	Relevant and Appropriate
35 IAC 724.199 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.99)	Compliance Monitoring Program: An owner or operator is required to establish a compliance monitoring program to meet the requirements of this section.	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.200 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.100)	Corrective Action: An owner or operator is required to establish a corrective action program in accordance with this section.	Relevant and Appropriate
35 IAC 212, Subpart K (Illinois Air Pollution regulations)	Measures need to be implemented to control fugitive dust emissions so that there will be no visible emissions at the property line and fugitive dust emissions do not exceed 20% opacity. Control measures typically include the application of water or other dust suppressants during clearing, grubbing, and grading.	Applicable
35 IAC 309.102 (Illinois NPDES Storm Water regulations Analogous to 40 CFR 122.26)	Storm water discharge requirements are applicable to activities at the Sauget Area 1 Sites involving disturbance of cover in an area of 1 acre or more total. The types of controls typical to SWPPP include, but are not limited to: storm water run-off conveyances, diversion dikes, sediment fences, sediment traps, limitations on the size of disturbed areas, and sequencing of construction to minimize and control disturbances.	Applicable
35 IAC 309.202 (Illinois Construction Permits)	Required State construction permit for any new water treatment works, sewer or wastewater sources or any modification to existing treatment works, sewer or wastewater sources.	Relevant and Appropriate
16 U.S.C. 1531 et seq., Sect. 7(a)(2) (U.S. Threatened and Endangered Species Act)	Actions that jeopardize the existence of a listed species, or result in the destruction or adverse modification of critical habitat, must be avoided or reasonable and prudent mitigation measures taken. The lead agency must determine whether threatened and endangered species or their critical habitat are present and conduct informal consultation with the U. S. Fish and Wildlife Service. Determination that threatened and endangered species or their critical habitat may be impacted by the proposed action requires preparation of a biological assessment to determine the extent of any possible impacts.	Applicable
520 ILCS 10/3 (Illinois Endangered Species Protection Act)	Prohibits actions that result in takings of state-listed species, such as actions that jeopardize the continued existence of a listed species or result in destruction or adverse modification of its critical habitat.	Applicable
35 IAC 724.211 a) and b) (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.111)	Closure Performance Standard: The owner or operator must close the facility in a manner that does the following: a) The closure minimizes the need for further maintenance; b) The closure controls, minimizes, or eliminates, to the extent necessary to adequately protect to human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous decomposition products to the ground or surface waters or to the atmosphere	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.212 a) and b) (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.112)	Closure Plan: Requires owners of hazardous waste facilities to submit a written closure plan (the approved plan becomes a condition to any RCRA permit). The closure plan describes the steps necessary for final closure. 724.212(a) (2), 724.212(b) (2) and 724.212(b) (4) are substantive requirements.	Relevant and Appropriate
35 IAC 724.214 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.114)	Disposal or Decontamination of Equipment, Structures, and Soil: All contaminated equipment, structures, and soils must be properly disposed of or decontaminated.	Relevant and Appropriate
35 IAC 724.215 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.115)	Certification of Closure: Within 60 days after completion of closure, the owner or operator must submit to the Agency, by registered mail, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved closure plan. The certification must be signed by the owner or operator and by an independent registered professional engineer.	Relevant and Appropriate
35 IAC 724.216 35 IAC 724.409 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care and Subpart N Landfills Surveying and Recordkeeping) similar to 40 CFR 264.116; 40 CFR 264.309)	Survey Plat: No later than the submission of the certification of closure of each hazardous waste disposal unit, the owner or operator must submit to any local zoning authority or authority with jurisdiction over local land use and to the Agency and record with land titles, a survey plat indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. This plat must be prepared and certified by a professional land surveyor. The plat filed with the local zoning authority or the authority with jurisdiction over local land use must contain a note, prominently displayed, that states the owner's and operator's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with Subpart G of this Part.	Relevant and Appropriate
35 IAC 724.217 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.117)	Postclosure Care and Use of Property a) Requires a Postclosure Care Period of at least 30 years after completion of closure for the unit b) must require continuation at partial or final closure of any of the security requirements of Section 724.114 during part or all of the post-closure period when either of the following is true: - hazardous wastes may remain exposed after completion of partial or final closure; or - access by the public or domestic livestock may pose a hazard to human health. d) All the post-closure care activities must be in accordance with the provisions of the approved post-closure plan as specified in Section 724.218.	Relevant and Appropriate
35 IAC 724.217 c) (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.117)	Postclosure Care and Use of Property c) Post-closure use of property on or in which hazardous wastes remain after closure must never be allowed to disturb the integrity of the final cover unless the Agency determines it is necessary for reasons listed in the regulations	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.218 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.118)	Post-Closure Plan The owner must have a written postclosure plan which must identify the activities that will be carried on after closure and the frequency of these activities (including planned monitoring activities and frequencies, planned maintenance activities, and name, address, and phone number of the person or office to contact). The relevant and appropriate requirements in 724.218 are: 724.218(b)(1) and (b)(2) – the post-closure plans must incorporate monitoring and maintenance activities that comply with the substantive requirements of 724 Subparts F and N.	Relevant and Appropriate
35 IAC 724.219 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.119)	Post-Closure Notices: Requires within 60 days after certification of closure the owner or operator of a disposal facility to submit to the Agency, to the County Recorder and to any local zoning authority or authority, a record of the type, location, and quantity of hazardous wastes disposed (for hazardous wastes disposed of before January 12, 1981, the owner or operator must identify these items to the best of the owner or operator's knowledge and in accordance with any records). In addition, the owner or operator is required to record a notation on the deed to the facility property (or on some other instrument that is normally examined during title search) that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous wastes; its use is restricted; and the survey plat and record of the type, location, and quantity of hazardous wastes disposed been filed with the Agency, the County Recorder and any local zoning authority or authority with jurisdiction over local land use.	Relevant and Appropriate
35 IAC 724.220 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.120)	Certification of Completion of Post-Closure Care: Within 60 days after completion of the established post-closure care period for each hazardous waste disposal unit, the owner or operator must submit to the Agency, by registered mail, a certification that the post-closure care period for the hazardous waste disposal unit was performed in accordance with the specifications in the approved post-closure plan.	Relevant and Appropriate
35 IAC 724.410 a)1 – 4 (Illinois RCRA Hazardous Waste regulations (Subpart N Landfills Closure and Postclosure Care) similar to 40 CFR 264.310(a))	At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to do the following: 1) Provide long-term minimization of migration of liquids through the closed landfill; 2) Function with minimum maintenance; 3) Promote drainage and minimize erosion or abrasion of the cover; 4) Accommodate settling and subsidence so that the cover's integrity is maintained	Item 1 Relevant But Not Appropriate to Site Conditions Items 2-4 Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.410 b) 1,4,5,and 6 (Illinois RCRA Hazardous Waste regulations (Subpart N Landfills Closure and Postclosure Care) similar to 40 CFR 264.310(b))	After final closure, the owner or operator must comply with all post-closure requirements contained in Sections 724.217 through 724.220, including maintenance and monitoring throughout the post-closure care period (specified in the permit under Section 724.217). After final closure the owner or operator must do the following: 1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events; 4) Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of Subpart F of this Part; 5) Prevent run-on and run-off from eroding or otherwise damaging the final cover; and 6) Protect and maintain surveyed benchmarks	Relevant and Appropriate
35 IAC 722.111 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 262.11)	Characterization of generated waste to determine if it is a hazardous waste. Any person who generates a solid waste must determine if that waste is hazardous by evaluation of whether the waste is excluded from hazardous waste regulation; listed under 35 IAC 721, Subpart D; or exhibits one of the hazardous waste characteristics under 35 IAC 721, Subpart C.	Applicable
40 CFR 761.61 (USEPA TSCA regulations)	Characterization of soils, liquids and decontamination fluids to determine whether they are PCB-remediation waste (as found concentrations of PCBs are 50 ppm or greater).	Applicable
35 IAC 728.109 a) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 268.7)	Requires a generator to determine whether generated hazardous waste is prohibited from land disposal, including waste codes, treatment standards and underlying hazardous constituents.	Applicable
35 IAC 722.134 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 262.34)	Allows for storage of hazardous waste in containers for 90 days or less while alleviating the need to meet all the requirements for a container storage area.	Applicable
35 IAC 724.275 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.175)	Design standards for hazardous waste container storage area.	Relevant and Appropriate
35 IAC 724.271 – 279 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.171 – 179)	Requirements for condition, handling, containment, compatibility, and marking containers used to store or treat hazardous waste or environmental media containing a hazardous waste.	Relevant and Appropriate
35 IAC 724.297 (Illinois Hazardous Waste regulations for tank systems)	Requirements for closure and post-closure care of a tank system. Applies to owners and operators of facilities that use tank systems for storing or treating hazardous waste.	Applicable
35 IAC 724.653 a) b) d) and e) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.553)	Requirements associated with establishing temporary storage of hazardous waste (hazardous soils, water, and decontamination fluids) in tanks or containers during remediation.	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.101 g) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.1(g))	Exemption from RCRA tank standards for tanks that are part of a wastewater treatment unit (tanks used to temporarily store hazardous wastewaters sent to a wastewater treatment facility for treatment on- or off-site).	Applicable
40 CFR 761.65 (USEPA TSCA regulations)	Storage area design and operation requirements for storage of TSCA-regulated PCB-containing wastes for disposal in containers.	Relevant and Appropriate
35 IAC 728.140 a) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 268.40(a))	Disposal requirement that all hazardous waste or hazardous waste containing media must meet applicable LDR treatment standards prior to disposal.	Applicable
35 IAC 722.130 – 134 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 262)	Pre-transport requirements requires the generator to package the waste, label each package, mark each package, and placard or offer the initial transporter the appropriate placards in accordance with the U. S. Department of Transportation regulations prior to transporting hazardous waste or offering hazardous waste for transportation off-site.	Applicable
35 IAC 722 and 723 92 IAC 171-178 (Illinois RCRA Hazardous Waste regulations and the Illinois Department of Transportation hazardous material regulations)	For any hazardous waste, all RCRA hazardous waste generator and transporter requirements including administrative requirements (manifests, EPA ID number, etc.) as well as the Illinois Department of Transportation requirement for hazardous materials (which incorporate the US Department of Transportation hazardous material regulations) would apply.	Applicable
35 IAC 742 (Illinois Tiered Approach to Corrective Action Objectives)	Sets forth procedures for evaluating the risk to human health posed by environmental conditions and developing remediation objectives that achieve acceptable risk levels based upon site-specific conditions.	To Be Considered
35 IAC 307.1101 (Illinois sewer discharge criteria)	Prohibition against discharge of certain types of pollutants into a Publicly Owned Treatment Works.	Relevant and Appropriate
35 IAC 809 (Illinois Special Waste Hauling regulations)	For wastes that meet the definition of a Special Waste (35 IAC 808) in Illinois, the special waste regulations, including administrative requirements, relating to manifesting and transport would apply.	Applicable
765 ILCS 122/1 et seq. Illinois' Uniform Environmental Covenants Act.	An owner or owners of real property may voluntarily enter into an environmental covenant, as a grantor of an interest in the real property, with an agency and, if appropriate, one or more holders. No owner, agency, or other person shall be required to enter into an environmental covenant as part of an environmental response project; provided, however, that (i) failure to enter into an environmental covenant may result in disapproval of the environmental response project; and (ii) once the owner, agency, or other person assumes obligations in an environmental covenant they must comply with those obligations of the environmental covenant in accordance with this Act.	To Be Considered

Note: ARAR Classifications include Applicable, Not Applicable, Relevant and Appropriate, Relevant But Not Appropriate, To Be Considered, and Waived.

Sauget Area 1 Site
Applicable or Relevant and Appropriate (ARARs)
Table

ARAR	Description of Requirements	Classification
35 IAC 620.405 (Illinois Groundwater Quality Standards)	Prohibits any person from causing, threatening, or allowing release of contaminants to groundwater resulting in exceedence of groundwater quality standards.	Applicable
35 IAC 620.410 (Illinois Groundwater Quality Standards)	Class 1 groundwater standards (in general equivalent to a drinking water standard or the MCL).	Applicable
35 IAC 620.250 (Illinois Groundwater Quality Standards)	A groundwater management zone (GMZ) may be established for a three dimensional region containing groundwater being managed to mitigate impairment caused by the release of contaminants from a site: (1) That is subject to a corrective action process approved by the Agency; or (2) For which the owner or operator undertakes an adequate corrective action in a timely and appropriate manner. The GMZ suspends the groundwater quality standards during the period of remediation until the groundwater quality standards have been attained.	Applicable
35 IAC 620.260 (Illinois Groundwater Quality Standards)	Any person may petition the Illinois Pollution Control Board to reclassify a groundwater in accordance with the procedures for adjusted standards specified in Section 28.1 of the Act and 35 Ill. Adm. Code 106, Subpart G. In any proceeding to reclassify specific groundwater by adjusted standard, in addition to the requirements of 35 Ill. Adm. Code 106, Subpart G, and Section 28.1(c) of the Act, the petition shall, at a minimum, contain information specified in this section.	Applicable
35 IAC 302.208 (Illinois Surface Water Quality Standards)	Numeric Surface Water Quality Standards are established for the protection of human health and aquatic life. The Mississippi River is not provided any specific surface water designation; therefore, the general use water quality standards would be applied. The general use water quality standards provide criteria for the protection of aquatic life (acute and chronic) and human health.	Applicable
35 IAC 302.210 (Illinois Surface Water Quality Standards)	Waters of the State shall be free from any substances or combination of substances in concentrations toxic or harmful to human health, or to animal, plant or aquatic life. This regulation includes those constituents without a promulgated standard in 35 IAC 302.208. These derived water quality criteria may be found on IEPA's web site (http://www.epa.state.il.us/water /water-quality-standards/water-quality-criteria.html) and will include any additional criteria that IEPA develops to address specific chemicals associated with the Sauget Area 1 Sites for which derived criteria have not been calculated already.	Applicable
35 IAC 301.108 (Illinois Water Quality and Pollution Control regulations general provisions)	The Illinois Pollution Control Board may grant an adjusted standard to an applicable regulatory standard for persons who can justify such an adjustment consistent with subsection (a) of section 27 of the Illinois Environmental Protection Act.	Applicable

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.191 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.91)	Required Programs: Owners and operators subject to Subpart F must conduct a monitoring and response program as follows: 1) Whenever hazardous constituents pursuant to Section 724.193 from a regulated unit are detected at a compliance point pursuant to Section 724.195, the owner or operator must institute a compliance monitoring program pursuant to Section 724.199. 2) Whenever the groundwater protection standard pursuant to Section 724.192 is exceeded, the owner or operator must institute a corrective action program pursuant to Section 724.200. 3) Whenever hazardous constituents pursuant to Section 724.193 from a regulated unit exceed concentration limits pursuant to Section 724.194 in groundwater between the compliance point pursuant to Section 724.195 and the downgradient facility property boundary, the owner or operator must institute a corrective action program pursuant to Section 724.200	Relevant and Appropriate
35 IAC 724.192 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.92)	Groundwater Protection Standard: The owner or operator must ensure that hazardous constituents under Section 724.193 detected in the groundwater from a regulated unit do not exceed the concentration limits under Section 724.194 in the uppermost aquifer underlying the waste management area beyond the point of compliance under Section 724.195 during the compliance period under Section 724.196.	Relevant and Appropriate
35 IAC 724.193 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.93)	Hazardous Constituents: The Agency must specify in the facility permit the hazardous constituents to which the groundwater protection standard of Section 724.192 applies. Hazardous constituents are constituents identified in Appendix H of 35 Ill. Adm. Code 721 that have been detected in groundwater in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless the Agency has excluded them under subsection (b) of this Section.	Relevant and Appropriate
35 IAC 724.194 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.94)	Concentration Limits: The Agency must specify in the facility permit concentration limits in the groundwater for hazardous constituents established under Section 724.193. The following must be true of the concentration of a hazardous constituent: 1) It must not exceed the background level of that constituent in the groundwater at the time that limit is specified in the permit; or, 2) For any of the constituents listed in Table 1, it must not exceed the respective value given in that Table if the background level of the constituent is below the value given in Table 1; or, 3) It must not exceed an alternative limit established by the Agency under subsection (b) of this Section.	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.195 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.95)	Point of Compliance: The Agency must specify in the facility permit the point of compliance at which the groundwater protection standard of Section 724.192 applies and at which monitoring must be conducted. The point of compliance is a vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units.	Relevant and Appropriate
35 IAC 724.196 a) (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.96 (a))	Compliance Period: The Agency must specify in the facility permit the compliance period during which the groundwater protection standard of Section 724.192 applies. The compliance period is the number of years equal to the active life of the waste management area (including any waste management activity prior to permitting, and the closure period.)	Relevant and Appropriate
35 IAC 724.197 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.97)	724.197(a) - The groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that fulfill the following requirements: 1) They represent the quality of background water, 2) They represent the quality of groundwater passing the point of compliance; and, 3) They allow for the detection of hazardous waste or hazardous constituents that have migrated to the uppermost aquifer. 724.197(c) - All monitoring wells must be cased in accordance with this section. 724.197(d) - The groundwater monitoring program must include consistent sampling and analysis to ensure a reliable indication of groundwater quality below the waste management area. The program must include procedures and techniques for the following: 1) Sample collection; 2) Sample preservation and shipment; 3) Analytical procedures; and 4) Chain of custody control. 724.197(e) - The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents in groundwater samples. 724.197(f) - The groundwater monitoring program must include a determination of the groundwater surface elevation each time groundwater is sampled. 724.197 (h) and (i) - Specifies the statistical methods that may be used in evaluating groundwater monitoring data and performance standards for each statistical method	Relevant and Appropriate
35 IAC 724.199 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.99)	Compliance Monitoring Program: An owner or operator is required to establish a compliance monitoring program to meet the requirements of this section.	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.200 (Illinois RCRA Hazardous Waste regulations (Subpart F General Groundwater Monitoring Requirements similar to 40 CFR 264.100)	Corrective Action: An owner or operator is required to establish a corrective action program in accordance with this section.	Relevant and Appropriate
35 IAC 212, Subpart K (Illinois Air Pollution regulations)	Measures need to be implemented to control fugitive dust emissions so that there will be no visible emissions at the property line and fugitive dust emissions do not exceed 20% opacity. Control measures typically include the application of water or other dust suppressants during clearing, grubbing, and grading.	Applicable
35 IAC 309.102 (Illinois NPDES Storm Water regulations Analogous to 40 CFR 122.26)	Storm water discharge requirements are applicable to activities at the Sauget Area 1 Sites involving disturbance of cover in an area of 1 acre or more total. The types of controls typical to SWPPP include, but are not limited to: storm water run-off conveyances, diversion dikes, sediment fences, sediment traps, limitations on the size of disturbed areas, and sequencing of construction to minimize and control disturbances.	Applicable
35 IAC 309.202 (Illinois Construction Permits)	Required State construction permit for any new water treatment works, sewer or wastewater sources or any modification to existing treatment works, sewer or wastewater sources.	Relevant and Appropriate
16 U.S.C. 1531 et seq., Sect. 7(a)(2) (U.S. Threatened and Endangered Species Act)	Actions that jeopardize the existence of a listed species, or result in the destruction or adverse modification of critical habitat, must be avoided or reasonable and prudent mitigation measures taken. The lead agency must determine whether threatened and endangered species or their critical habitat are present and conduct informal consultation with the U. S. Fish and Wildlife Service. Determination that threatened and endangered species or their critical habitat may be impacted by the proposed action requires preparation of a biological assessment to determine the extent of any possible impacts.	Applicable
520 ILCS 10/3 (Illinois Endangered Species Protection Act)	Prohibits actions that result in takings of state-listed species, such as actions that jeopardize the continued existence of a listed species or result in destruction or adverse modification of its critical habitat.	Applicable
35 IAC 724.211 a) and b) (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.111)	Closure Performance Standard: The owner or operator must close the facility in a manner that does the following: a) The closure minimizes the need for further maintenance; b) The closure controls, minimizes, or eliminates, to the extent necessary to adequately protect to human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous decomposition products to the ground or surface waters or to the atmosphere	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.212 a) and b) (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.112)	Closure Plan: Requires owners of hazardous waste facilities to submit a written closure plan (the approved plan becomes a condition to any RCRA permit). The closure plan describes the steps necessary for final closure. 724.212(a) (2), 724.212(b) (2) and 724.212(b) (4) are substantive requirements.	Relevant and Appropriate
35 IAC 724.214 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.114)	Disposal or Decontamination of Equipment, Structures, and Soil: All contaminated equipment, structures, and soils must be properly disposed of or decontaminated.	Relevant and Appropriate
35 IAC 724.215 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.115)	Certification of Closure: Within 60 days after completion of closure, the owner or operator must submit to the Agency, by registered mail, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved closure plan. The certification must be signed by the owner or operator and by an independent registered professional engineer.	Relevant and Appropriate
35 IAC 724.216 35 IAC 724.409 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care and Subpart N Landfills Surveying and Recordkeeping) similar to 40 CFR 264.116; 40 CFR 264.309)	Survey Plat: No later than the submission of the certification of closure of each hazardous waste disposal unit, the owner or operator must submit to any local zoning authority or authority with jurisdiction over local land use and to the Agency and record with land titles, a survey plat indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. This plat must be prepared and certified by a professional land surveyor. The plat filed with the local zoning authority or the authority with jurisdiction over local land use must contain a note, prominently displayed, that states the owner's and operator's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with Subpart G of this Part.	Relevant and Appropriate
35 IAC 724.217 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.117)	Postclosure Care and Use of Property a) Requires a Postclosure Care Period of at least 30 years after completion of closure for the unit b) must require continuation at partial or final closure of any of the security requirements of Section 724.114 during part or all of the post-closure period when either of the following is true: - hazardous wastes may remain exposed after completion of partial or final closure; or - access by the public or domestic livestock may pose a hazard to human health. d) All the post-closure care activities must be in accordance with the provisions of the approved post-closure plan as specified in Section 724.218.	Relevant and Appropriate
35 IAC 724.217 c) (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.117)	Postclosure Care and Use of Property c) Post-closure use of property on or in which hazardous wastes remain after closure must never be allowed to disturb the integrity of the final cover unless the Agency determines it is necessary for reasons listed in the regulations	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.218 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.118)	Post-Closure Plan The owner must have a written postclosure plan which must identify the activities that will be carried on after closure and the frequency of these activities (including planned monitoring activities and frequencies, planned maintenance activities, and name, address, and phone number of the person or office to contact). The relevant and appropriate requirements in 724.218 are: 724.218(b)(1) and (b)(2) – the post-closure plans must incorporate monitoring and maintenance activities that comply with the substantive requirements of 724 Subparts F and N.	Relevant and Appropriate
35 IAC 724.219 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.119)	Post-Closure Notices: Requires within 60 days after certification of closure the owner or operator of a disposal facility to submit to the Agency, to the County Recorder and to any local zoning authority or authority, a record of the type, location, and quantity of hazardous wastes disposed (for hazardous wastes disposed of before January 12, 1981, the owner or operator must identify these items to the best of the owner or operator's knowledge and in accordance with any records). In addition, the owner or operator is required to record a notation on the deed to the facility property (or on some other instrument that is normally examined during title search) that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous wastes; its use is restricted; and the survey plat and record of the type, location, and quantity of hazardous wastes disposed been filed with the Agency, the County Recorder and any local zoning authority or authority with jurisdiction over local land use.	Relevant and Appropriate
35 IAC 724.220 (Illinois RCRA Hazardous Waste regulations (Subpart G Closure and Postclosure Care) similar to 40 CFR 264.120)	Certification of Completion of Post-Closure Care: Within 60 days after completion of the established post-closure care period for each hazardous waste disposal unit, the owner or operator must submit to the Agency, by registered mail, a certification that the post-closure care period for the hazardous waste disposal unit was performed in accordance with the specifications in the approved post-closure plan.	Relevant and Appropriate
35 IAC 724.410 a)1 – 4 (Illinois RCRA Hazardous Waste regulations (Subpart N Landfills Closure and Postclosure Care) similar to 40 CFR 264.310(a))	At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to do the following: 1) Provide long-term minimization of migration of liquids through the closed landfill; 2) Function with minimum maintenance; 3) Promote drainage and minimize erosion or abrasion of the cover; 4) Accommodate settling and subsidence so that the cover's integrity is maintained	Item 1 Relevant But Not Appropriate to Site Conditions Items 2-4 Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.410 b) 1,4,5,and 6 (Illinois RCRA Hazardous Waste regulations (Subpart N Landfills Closure and Postclosure Care) similar to 40 CFR 264.310(b))	After final closure, the owner or operator must comply with all post-closure requirements contained in Sections 724.217 through 724.220, including maintenance and monitoring throughout the post-closure care period (specified in the permit under Section 724.217). After final closure the owner or operator must do the following: 1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events; 4) Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of Subpart F of this Part; 5) Prevent run-on and run-off from eroding or otherwise damaging the final cover; and 6) Protect and maintain surveyed benchmarks	Relevant and Appropriate
35 IAC 722.111 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 262.11)	Characterization of generated waste to determine if it is a hazardous waste. Any person who generates a solid waste must determine if that waste is hazardous by evaluation of whether the waste is excluded from hazardous waste regulation; listed under 35 IAC 721, Subpart D; or exhibits one of the hazardous waste characteristics under 35 IAC 721, Subpart C.	Applicable
40 CFR 761.61 (USEPA TSCA regulations)	Characterization of soils, liquids and decontamination fluids to determine whether they are PCB-remediation waste (as found concentrations of PCBs are 50 ppm or greater).	Applicable
35 IAC 728.109 a) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 268.7)	Requires a generator to determine whether generated hazardous waste is prohibited from land disposal, including waste codes, treatment standards and underlying hazardous constituents.	Applicable
35 IAC 722.134 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 262.34)	Allows for storage of hazardous waste in containers for 90 days or less while alleviating the need to meet all the requirements for a container storage area.	Applicable
35 IAC 724.275 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.175)	Design standards for hazardous waste container storage area.	Relevant and Appropriate
35 IAC 724.271 – 279 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.171 – 179)	Requirements for condition, handling, containment, compatibility, and marking containers used to store or treat hazardous waste or environmental media containing a hazardous waste.	Relevant and Appropriate
35 IAC 724.297 (Illinois Hazardous Waste regulations for tank systems)	Requirements for closure and post-closure care of a tank system. Applies to owners and operators of facilities that use tank systems for storing or treating hazardous waste.	Applicable
35 IAC 724.653 a) b) d) and e) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.553)	Requirements associated with establishing temporary storage of hazardous waste (hazardous soils, water, and decontamination fluids) in tanks or containers during remediation.	Relevant and Appropriate

Sauget Area 1 ARARs Table

ARAR	Description of Requirements	Classification
35 IAC 724.101 g) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 264.1(g))	Exemption from RCRA tank standards for tanks that are part of a wastewater treatment unit (tanks used to temporarily store hazardous wastewaters sent to a wastewater treatment facility for treatment on- or off-site).	Applicable
40 CFR 761.65 (USEPA TSCA regulations)	Storage area design and operation requirements for storage of TSCA-regulated PCB-containing wastes for disposal in containers.	Relevant and Appropriate
35 IAC 728.140 a) (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 268.40(a))	Disposal requirement that all hazardous waste or hazardous waste containing media must meet applicable LDR treatment standards prior to disposal.	Applicable
35 IAC 722.130 – 134 (Illinois RCRA Hazardous Waste regulations similar to 40 CFR 262)	Pre-transport requirements requires the generator to package the waste, label each package, mark each package, and placard or offer the initial transporter the appropriate placards in accordance with the U. S. Department of Transportation regulations prior to transporting hazardous waste or offering hazardous waste for transportation off-site.	Applicable
35 IAC 722 and 723 92 IAC 171-178 (Illinois RCRA Hazardous Waste regulations and the Illinois Department of Transportation hazardous material regulations)	For any hazardous waste, all RCRA hazardous waste generator and transporter requirements including administrative requirements (manifests, EPA ID number, etc.) as well as the Illinois Department of Transportation requirement for hazardous materials (which incorporate the US Department of Transportation hazardous material regulations) would apply.	Applicable
35 IAC 742 (Illinois Tiered Approach to Corrective Action Objectives)	Sets forth procedures for evaluating the risk to human health posed by environmental conditions and developing remediation objectives that achieve acceptable risk levels based upon site-specific conditions.	To Be Considered
35 IAC 307.1101 (Illinois sewer discharge criteria)	Prohibition against discharge of certain types of pollutants into a Publicly Owned Treatment Works.	Relevant and Appropriate
35 IAC 809 (Illinois Special Waste Hauling regulations)	For wastes that meet the definition of a Special Waste (35 IAC 808) in Illinois, the special waste regulations, including administrative requirements, relating to manifesting and transport would apply.	Applicable
765 ILCS 122/1 et seq. Illinois' Uniform Environmental Covenants Act.	An owner or owners of real property may voluntarily enter into an environmental covenant, as a grantor of an interest in the real property, with an agency and, if appropriate, one or more holders. No owner, agency, or other person shall be required to enter into an environmental covenant as part of an environmental response project; provided, however, that (i) failure to enter into an environmental covenant may result in disapproval of the environmental response project; and (ii) once the owner, agency, or other person assumes obligations in an environmental covenant they must comply with those obligations of the environmental covenant in accordance with this Act.	To Be Considered

Note: ARAR Classifications include Applicable, Not Applicable, Relevant and Appropriate, Relevant But Not Appropriate, To Be Considered, and Waived.

APPENDIX B

FEASIBILITY STUDY COST ESTIMATE FOR ALTERNATIVE 5

Table F-5
Cost Estimate Summary- Alternative 5
Sauget Area 1 FS, Sauget and Cahokia, IL

Description of Alternative 5:
Alternative 5 includes MNA, Judith Lane Containment Cell O&M, institutional controls, utility relocation, pooled DNAPL recovery at well BR-I, soil or gravel covers at Sites G, H, I South, and L; and biosparging at DNAPL areas at Sites G, H, and I South. Capital costs occur in Year 0. Annual O&M costs occur in years 1 to 10 for biosparging at Sites G, H, and I South and pooled DNAPL recovery at BR-I. Annual O&M costs occur in years 1 to 30 for all other remedy components.

CAPITAL COSTS

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
Installation of Wells for MNA Sampling Program					
Monitoring wells in SHU	8	EA	$3,400	$27,200	
Monitoring wells in MHU	13	EA	$6,600	$85,800	
Monitoring wells in DHU	13	EA	$7,800	$101,400	
SUBTOTAL				$214,400	
Relocation of water fuel and phone lines	1	LS	$512,000	$512,000	
DNAPL Recovery System Modification	1	LS	$14,400	$14,400	
Soil Cover Site G (2.53 acres)	1	LS	$383,000	$383,000	
Asphalt Cover Site G West (0.79 acres)	1	LS	$101,000	$101,000	
Soil Cover Site H (4.87 acres)	1	LS	$731,000	$731,000	
Rock Cover Site I South (8.79 acres)	1	LS	$695,000	$695,000	
Soil Cover Site L (1.08 acres)	1	LS	$148,000	$148,000	
SUBTOTAL				$2,058,000	
Biosparging PilotTest					
Biosparge Well Pairs (MHU & DHU)	4	EA	$13,600	$54,400	
Vent Wells (35ft0	4	EA	$4,200	$16,800	
Monitoring Well Pairs (MHU & DHU)	10	EA	$13,600	$136,000	
Install system, startup, operate 1 year and report	1	LS	$213,000	$213,000	
SUBTOTAL				$420,200	
Biosparging System Installation					
Biosparge Well Pairs (MHU & DHU)	78	EA	$13,600	$1,060,800	
Vent Wells (35ft)	78	EA	$4,200	$327,600	
Install Piping, compressors, enclosures, controls	1	LS	$860,000	$860,000	
SUBTOTAL				$2,248,400	
SUBTOTAL				$5,467,400	
Contingency	25%			$1,366,850	15% scope + 10% bid
SUBTOTAL				$6,834,250	
Project Management	5%			$341,713	
Remedial Design	8%			$546,740	
Construction Management	6%			$410,055	
Institutional Controls					
Institutional Controls Plan	1	LS	$8,000	$8,000	
Security Fence at Sites H and L	2800	LF	$53	$148,702	
Hazardous Waste Signing	14	EA	$72	$1,011	
Prepare & file deed notices	1	LS	$20,000	$20,000	Legal fees
Site information database	1	LS	$5,000	$5,000	Set up data mgt system
SUBTOTAL				$182,713	
TOTAL CAPITAL COST				$8,315,471	

Table F-5
Cost Estimate Summary- Alternative 5
Sauget Area 1 FS, Sauget and Cahokia, IL

O&M COSTS, Years 1 to 10

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
MNA Sampling (34 wells for VOCs, SVOCs, geochemical indicators)					
Semiannual GW sampling & testing	2	1/2-YR	$37,300	$74,600	
Annual GW monitoring report	1	YR	$15,000	$15,000	
SUBTOTAL				$89,600	
Judith Lane Containment Cell O&M					
Judith Lane Containment Cell O&M	1	YR	$30,000	$30,000	
Judith Lane Containment Cell Well Sampling	4	QTR	$4,900	$19,600	
SUBTOTAL				$49,600	
DNAPL Recovery System					
Recovery System O&M	1	YR	$23,700	$23,700	
Transportation and Disposal of DNAPL and Water	1	YR	$33,500	$33,500	
SUBTOTAL				$57,200	
Maintenance of Covers	1	YR	$35,000	$35,000	
Biosparging System O&M	1	YR	$243,000	$243,000	
SUBTOTAL				$474,400	
Contingency	25%			$118,600	15% scope + 10% bid
SUBTOTAL				$593,000	
Project Management	8%			$47,440	
Technical Support	10%			$59,300	
ICs - site info database	1	LS	$1,000	$1,000	Update database
TOTAL ANNUAL O&M COST				$700,700	

Table F-5
Cost Estimate Summary- Alternative 5
Sauget Area 1 FS, Sauget and Cahokia, IL

O&M COSTS, Years 11 to 30

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
MNA Sampling (34 wells for VOCs, SVOCs, geochemical indicators)					
Semiannual GW sampling & testing	2	1/2-YR	$37,300	$74,600	
Annual GW monitoring report	1	YR	$15,000	$15,000	
SUBTOTAL				$89,600	
Judith Lane Containment Cell O&M					
Judith Lane Containment Cell O&M	1	YR	$30,000	$30,000	
Judith Lane Containment Cell Wall Sampling	4	QTR	$4,900	$19,600	
SUBTOTAL				$49,600	
DNAPL Recovery System O&M (not applicable)				$0	
Maintenance of Covers	1	YR	$35,000	$35,000	
Biosparging System O&M (not applicable)				$0	
SUBTOTAL				$174,200	
Contingency	25%			$43,550	15% scope + 10% bid
SUBTOTAL				$217,750	
Project Management	8%			$17,420	
Technical Support	10%			$21,775	
ICs - site info database	1	LS	$1,000	$1,000	Update database
TOTAL ANNUAL O&M COST				$257,945	

Table F-5
Cost Estimate Summary- Alternative 5
Sauget Area 1 FS, Sauget and Cahokia, IL

PERIODIC COSTS

DESCRIPTION	YEAR	QTY	UNITS	UNIT RATE	TOTAL	
Five Year Review Report	5	1	LS	$50,000	$50,000	Report at end of Year 5
Update ICs Plan	5	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$53,000	
Five Year Review Report	10	1	LS	$30,000	$30,000	Report at end of Year 10
Update ICs Plan	10	1	LS	$3,000	$3,000	Updated plan
Plug Biosparging Wells	10	1	LS	$137,000	$137,000	
Decommission Biosparging Systems	10	7	LS	$2,500	$17,500	
SUBTOTAL					$187,500	
Five Year Review Report	15	1	LS	$20,000	$20,000	Report at end of Year 15
Update ICs Plan	15	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	20	1	LS	$20,000	$20,000	Report at end of Year 20
Update ICs Plan	20	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	25	1	LS	$20,000	$20,000	Report at end of Year 25
Update ICs Plan	25	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	30	1	LS	$20,000	$20,000	Report at end of Year 30
Update ICs Plan	30	1	LS	$3,000	$3,000	Updated plan
Plug Monitoring Wells	30	1	LS	$26,600	$26,600	
SUBTOTAL					$49,600	
TOTAL PERIODIC COST					$359,100	

PRESENT VALUE ANALYSIS

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)	PRESENT VALUE
Capital Cost	0	$ 8,315,471	$8,315,471	1.000	$8,315,471
Annual O&M Cost	1 to 10	$7,007,400	$700,740	see calc	$4,921,705
Annual O&M Cost	11 to 30	$5,158,900	$257,945	see calc	$1,389,152
Periodic Cost	5	$53,000	$53,000	0.713	$37,788
Periodic Cost	10	$187,500	$187,500	0.508	$95,315
Periodic Cost	15	$23,000	$23,000	0.362	$8,338
Periodic Cost	20	$23,000	$23,000	0.258	$5,944
Periodic Cost	25	$23,000	$23,000	0.184	$4,238
Periodic Cost	30	$49,600	$49,600	0.131	$6,516
		$20,840,871			$14,784,465

TOTAL PRESENT VALUE COST FOR ALTERNATIVE 5	$14,784,465

APPENDIX C

SUMMARY OF CONSTITUENTS OF CONCERN AND REMEDIAL GOAL OPTIONS

TABLE 8-8
SUMMARY OF CONSTITUENTS OF CONCERN
SAUGET AREA 1

Area	Receptor	Medium	Pathway	COC	Cancer Potential Risk		Non-Cancer Hazard		Remedial	Units	Document
					RME	MLE	RME HQ	MLE HQ	Goal Options		
Site G	Construction worker	Groundwater	inhalation	Benzene	1.78E-07	5.33E-08	9.50E-01	2.85E-01	(a)	--	ENSR. 2001
Site G	Construction worker	Leachate	inhalation	Benzene	8.21E-08	2.46E-08	4.39E-01	1.32E-01	(a)	--	ENSR. 2001
Site G	Construction worker	Leachate	inhalation	Chlorobenzene	NC	NC	3.83E-01	1.15E-01	(a)	--	ENSR. 2001
Site G	Construction worker	Groundwater	inhalation	Naphthalene	NC	NC	9.93E-01	2.98E-01	(a)	--	ENSR. 2001
Site G	Construction worker	Leachate	inhalation	Naphthalene	NC	NC	7.98E-01	2.39E-01	(a)	--	ENSR. 2001
Site G	Construction worker	Subsurface Soil	ing/derm	Phosphorus	NC	NC	7.07E+00	1.36E+00	(a)	--	ENSR. 2001
Site G	Construction worker	Subsurface Soil	ing/derm	Total PCBs	2.15E-05	1.59E-06	3.76E+01	2.79E+00	(a)	--	ENSR. 2001
Site H	Utility Worker	Soil/Waste	ing/derm/inh	2,3,7,8-TCDD TEQ	8.55E-03	2.46E-04	1.59E+02	1.62E+01	6.38E-04	mg/kg	ENSR. 2008
Site H	Utility Worker	Soil/Waste	ing/derm	4,4-DDD	5.28E-05	5.28E-05	1.23E+00	1.23E-01	1.80E+02	mg/kg	ENSR. 2008
Site H	Utility Worker	Soil/Waste	ing/derm/inh	4,4-DDT	6.07E-05	1.71E-06	9.96E-01	9.96E-02	1.71E+02	mg/kg	ENSR. 2008
Site H	Utility Worker	Soil/Waste	inhalation	Barium	NC	NC	1.08E+00	3.24E-01	7.60E+04	mg/kg	ENSR. 2008
Site H	Utility Worker	Soil/Waste	inhalation	Chlorobenzene	NC	NC	1.77E+00	5.31E-01	8.25E+02	mg/kg	ENSR. 2008
Site H	Utility Worker	Soil/Waste	ing/derm/inh	Dieldrin	4.99E-04	1.45E-05	1.74E+00	1.81E-01	2.43E+00	mg/kg	ENSR. 2008
Site H	Utility Worker	Soil/Waste	ing/derm/inh	Total PCBs	6.61E-03	1.96E-04	4.62E+02	4.87E+01	1.34E+01	mg/kg	ENSR. 2008
Site H	Construction worker	Groundwater	inhalation	Benzene	1.75E-07	5.25E-08	9.35E-01	2.81E-01	(a)	--	ENSR. 2001
Site H	Construction worker	Leachate	inhalation	Benzene	2.33E-07	1.46E-08	1.25E+00	7.83E-02	(a)	--	ENSR. 2001
Site H	Construction worker	Leachate	ing/derm	Cadmium	NC	NC	2.39E+00	2.45E-01	(a)	--	ENSR. 2001
Site H	Construction worker	Groundwater	inhalation	Chloroform	1.38E-07	4.15E-08	2.12E+00	6.36E-01	(a)	--	ENSR. 2001
Site H	Construction worker	Subsurface Soil	inhalation	Manganese	NC	NC	4.81E+00	1.52E-01	(a)	--	ENSR. 2001
Site H	Construction worker	Subsurface Soil	ing/derm	Total PCBs	8.73E-05	4.80E-06	1.53E+02	8.40E+00	(a)	--	ENSR. 2001
Site I	Outdoor Worker	Surface Soil	ing/derm	2,3,7,8-TCDD TEQ	1.35E-04	6.83E-06	NC	NC	6.20E-03	mg/kg	ENSR. 2001
Site I	Outdoor Worker	Surface Soil	ing/derm	Total PCBs	2.85E-05	1.28E-06	1.99E+00	3.21E-01	6.10E+01	mg/kg	ENSR. 2001
Site I	Construction Worker	Subsurface Soil	ing/derm	Antimony	NC	NC	2.72E+00	2.99E-01	(a)	--	ENSR. 2001
Site I	Construction Worker	Leachate	inhalation	Chlorobenzene	NC	NC	1.22E+00	1.07E-01	(a)	--	ENSR. 2001
Site I	Construction Worker	Leachate	inhalation	Chloroform	1.89E-06	1.43E-07	2.89E+01	2.19E+00	(a)	--	ENSR. 2001
Site I	Construction Worker	Leachate	ing/derm	MCPP	NC	NC	5.74E-01	2.87E-01	(a)	--	ENSR. 2001
Site I	Construction Worker	Leachate	inhalation	Naphthalene	NC	NC	1.99E+00	5.98E-01	(a)	--	ENSR. 2001
Site I	Construction Worker	Leachate	ing/derm	Total PCBs	3.14E-06	1.57E-06	5.50E+00	2.75E+00	(a)	--	ENSR. 2001
Site I	Construction Worker	Subsurface Soil	ing/derm	Total PCBs	1.66E-06	3.17E-07	2.91E+00	5.55E-01	(a)	--	ENSR. 2001
Site I	Construction Worker	Surface Soil	ing/derm	Total PCBs	5.88E-07	5.49E-08	1.03E+00	9.62E-02	(a)	--	ENSR. 2001
Site L	Construction worker	Subsurface Soil	ing/derm	Total PCBs	2.42E-06	4.53E-07	4.24E+00	7.93E-01	(a)	--	ENSR. 2001

Notes:
2,3,7,8-TCDD TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration
ENSR. 2001. Sauget Area 1 Human Health Risk Assessment. Sauget and Cahokia, Illinois. June 1, 2001 Revision 1 and August 31, 2001 Revision 2. USEPA Approved (November 13, 2001).
ENSR. 2008. Sauget Area 1 Utility Corridor Evaluation Human Health Risk Assessment. August 2008. USEPA Approved (September 10, 2008).
ing/derm - incidental ingestion and dermal contact.
inh - inhalation
MCPP - 2-(2-Methyl-4-chlorophenoxy) propionic acid.
NC - Not Calculated. No dose-response value.
PCB - Polychlorinated Biphenyl.
Highlighting indicates that the potential risk or hazard is greater than the target risk level of 1E-4 or a hazard index of one on a target organ basis, or that the potential risk or hazard drives the total above the targets.
(a) A range of remedial goal options are available, including institutional controls. Therefore, numeric remedial goal options were not derived. These COCs should be considered when making remedial decisions.

APPENDIX E

TSCA 40 CFR SECTION 761.61(C)

DETERMINATION MEMO

APPENDIX D

TSCA 40 CFR SECTION 761.61(C)

DETERMINATION MEMORANDUM

Attachment D - TSCA 40 CFR Section 761.61(c) Determination

The Sauget Area 1 Site, located in Sauget, Illinois, consists of three closed waste disposal areas (Sites G, H, and I), a backfilled impoundment (Site L), an inactive borrow pit (Site M), a closed construction debris disposal area (Site N), and approximately 3.5 miles of Dead Creek. All of the sites in Sauget Area 1 contain or formerly contained varying amounts of PCB contamination.

Starting in 2000, Dead Creek and Site M sediments and creek bottom soils were remediated through Unilateral Administrative Orders (UAOs), in which EPA required potential responsible parties (PRP) to complete a Time-Critical Removal Action in Dead Creek to address risks associated with flooding and contamination in Dead Creek. Under the terms of the UAO, the PRPs, with EPA oversight, constructed a Toxic Substances Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA)-compliant double lined containment cell, which includes a leachate collection and treatment system, adjacent to Dead Creek Segment B. Under the UAO, approximately 58,300 cubic yards of PCB contaminated sediments and soils from Dead Creek and Site M were placed in the containment cell. Post-excavation confirmatory sampling in the Dead Creek and Site M areas confirmed that sediments and creek bottom soils above risk-based concentrations (0.58 parts per million (ppm)) were removed; therefore, risks to human health and the environment have been removed and no further remedial action is warranted in these areas.

The remaining PCB containing areas at the Sauget Area 1 Site are the disposal areas at Sites G, H, I South, and L. These disposal areas contain municipal and industrial waste materials, including crushed or partially crushed drums, drum fragments, uncontained soil and liquid wastes, wood, glass, paper, construction debris, and miscellaneous trash. Collectively, Sites G, H, I South, and L contain an estimated 637,000 cubic yards of soil and waste. The lower portion of the waste at these Sites is below the water table. Remedial investigation sampling at Sites G, H, I South, and L revealed PCB levels in the soil above 50 ppm. Soil samples taken from subsurface soil and waste showed PCB concentrations ranging from 13 to 4,430 ppm at Site G, 0.25 to 18,000 ppm at Site H, 20 to 343 ppm at I South, and 16 to 500 ppm at Site L. In addition, there is residual DNAPL in the aquifer matrix underlying portions of Sites G, H, and I South. The dissolution of residual DNAPL in the aquifers beneath Sites G, H, and I South is an on-going source of contamination to downgradient groundwater. However, groundwater sampling results showed PCB concentrations ranging from non-detect to 0.2 ppm in the shallow hydraulic unit, non-detect to 8.0×10^{-4} ppm in the middle hydraulic unit, and non-detect to 12.0×10^{-3} ppm in the deep hydraulic unit. Overall, because PCBs are relatively insoluable in water, concentrations of PCBs in groundwater occur sporadically and at comparatively low concentrations both upgradient and downgradient of the disposal areas, throughout the aquifer. Therefore, groundwater is not significantly impacted by PCBs and PCBs contaminated wastes are contained within the disposal areas.

The PCB-contaminated soils and wastes in the disposal areas in Sauget Area 1 Sites G, H, I South, and L meet the definition of a PCB remediation waste as defined under 40 CFR §

761.3 because the soils and wastes contain PCBs as a result of a spill, release or unauthorized disposal which occurred prior to April 18, 1978, and thus are regulated for cleanup and disposal under 40 CFR Part 761. In accordance with the requirements under TSCA and 40 CFR § 761.61(c), I have reviewed the Administrative Record for the Sauget Area 1 Site (Site) and considered the Selected Remedy for OU1 at the Sauget Area 1 Site.

The Selected Remedy for OU1 consists of recovering pooled dense non-aqueous phase liquid (DNAPL) at Site I South; installing and operating of several pulsed air biosparging systems at residual DNAPL areas beneath Sites G, H, and I South; installing 35 IAC § 724 compliant soil or crushed rock caps at Sites G, H, I South, and L, and an asphalt pavement cap at Site G West; relocating utilities in the utility corridor adjacent to Site H, south of Queeny Avenue; operating and maintaining the Judith Lane containment cell; operating the groundwater monitoring well network; and establishing and enforcing institutional and access controls at Sites G, H, I South, and L. Prior response actions addressed risks associated with contamination in Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake and Site M; and Site I South and Site N have acceptable risks under current exposure scenarios. Therefore no further action is required in these areas of the Site.

The Selected Remedy for OU1 addresses principal threat wastes that are present on the Site. A "principal threat" waste is a source material that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. Principal threat wastes have been identified in the following two areas at the Site: pooled DNAPL that is present at Site I South and subsurface soils contaminated with polychlorinated biphenyls (PCBs) and 2,3,7,8-TCDD-TEQ (dioxins) with risks above EPA's principal threat waste threshold of $1x10^{-3}$ in the utility corridor along Queeny Avenue, adjacent to Site H. The Selected Remedy addresses these areas by treating the DNAPL recovered at Site I South through off-Site incineration and by relocating the utilities in the utility corridor to prevent unacceptable potential direct contact risk to utility workers during excavation work.

Potential risks remaining at the Site related to PCB contamination is through potential direct contact to soils and waste contaminated with PCBs. To address or eliminate the direct contact exposure pathway, engineering controls[1] in the form of engineered covers are used in the Selected Remedy. Specifically, engineered covers meeting the requirements of 35 IAC § 724 compliant caps will be installed over Sites G, H, I South, and L.

Under 40 CFR § 761.61(c), PCB remediation waste may be disposed of in a manner other than prescribed under Section 761.61(a) or (b), provided EPA determines that the method of disposal does not result in an unreasonable risk of injury to health or the environment. The Selected Remedy set forth in the Sauget Area 1 OU1 ROD implements both containment and

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[1] Engineering controls encompass a variety of engineered and constructed physical barriers (e.g., soil capping, sub-surface venting systems, mitigation barriers, fences) to contain and/or prevent exposure to contamination on a property.

treatment remedies. Specifically, the 35 IAC § 724 compliant caps prevent or minimize human exposure, infiltration of water, and erosion in accordance with 40 C.F.R. § 761.61(a)(7)[2]. The additional remedy components of the selected remedy at the Sauget Area 1 Sites include pooled DNAPL recovery at Site I; pulsed air biosparging at DNAPL residual areas at Sites G, H, and I South to promote in-situ aerobic biodegradation to reduce the mass of contaminants COCs in the aquifer; utility relocation to prevent exposure to maintenance workers; containment cell operation and maintenance; monitoring well network; and institutional controls placed on Sauget Area 1 Sites G, H, I, and L to prevent interference with the remedy by future users. As discussed above, PCB concentrations in groundwater occur only sporadically and at comparatively low concentrations both upgradient and downgradient of the disposal areas, throughout the aquifer. In any case, impacted groundwater from Sauget Area 1 moves toward the west, toward the Mississippi River, which mostly naturally attenuates prior to reaching the River, and also most of the groundwater that does reach the River is captured and treated by the Sauget Area 2 Groundwater Migration Containment System.

The Selected Remedy is expected to achieve substantial and long-term risk reduction through treatment, it is expected to prevent future exposure to currently contaminated soils and groundwater, and it is expected to allow the property to be used for the reasonably anticipated future land use, which is industrial. Based on the information provided, the containment and treatment remedies for the Sauget Area 1 Sites G, H, I South, and L will ensure that the PCBs remaining in the subsoils in Sauget Area 1 will not pose an unreasonable risk of injury to health or the environment.

Richard C. Karl, Director
Superfund Division
EPA Region 5

9-24-13
Date

[2] Under the Selected Remedy, the 35 IAC § 724 cap will meet the performance standards of a fully designed RCRA Subtitle C cap, except the component stating the need to provide for long-term minimization of migration of liquids (through the placement of an impearmible cap). EPA determined that this component of the Section 724 cap is not appropriate because an impermeable cap would not affect significant change on the rate of leaching in the groundwater due to the physical conditions at the Site. Specifically, EPA determined that because the lower portion of waste at the Sauget Area 1 sites is already below the water table, that no principal threat liquids or mobile source materials were identified in the wastes above the water table, and mass flux of key contaminants of concern (COCs) is due to lateral groundwater flow, not from the potential leaching effect of COCs from infiltrating rainfall. Thus, the installation of caps to prevent infiltration of rainwater at Sauget Area 1 would not impact flushing effects from the rising and falling water table that normally cause groundwater migration or leaching effect of COCs from rainfall, and therefore would have no significant effect on the migration of contaminated groundwater.

APPENDIX E

STATE CONCURRENCE LETTER

DECLARATION FOR THE RECORD OF DECISION

Selected Remedy for the
Sauget Area 1 Proposed NPL Site – Operable Unit 1
Sauget and Cahokia, St. Clair County, Illinois

SITE NAME AND LOCATION

1630200005 – St. Clair County
Sauget Area 1 Proposed NPL Site – Operable Unit 1
CERCLIS Identification Number: ILD 980 792 006
Villages of Sauget and Cahokia, St. Clair County, Illinois

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial actions for the Operable Unit 1 of the Sauget Area 1 site. The United States Environmental Protection Agency (USEPA), in consultation with the Illinois Environmental Protection Agency (Illinois EPA), is choosing these remedies in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA or Superfund) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 Code of Federal Regulations (CFR) 300-399). All decisions have been made based upon the Administrative Record for the Sauget Area 1 site. This declaration indicates the State of Illinois' concurrence with the selection of Alternative 5 from the Final Feasibility Study for Sauget Area 1.

ASSESSMENT OF THE SITE

The response actions selected in the Record of Decision (ROD) are necessary to protect the public health or welfare and the environment from the actual or threatened release of hazardous substances, pollutants or contaminants into the environment.

DESCRIPTION OF THE SELECTED REMEDY

USEPA, Illinois EPA and potentially responsible parties (PRPs) have implemented extensive clean-up activities in Sauget Area 1 already. These actions have addressed some of the contaminant source materials formerly present at the site. The selected remedy will address remaining contaminant source materials at the site and will be the first of two remedial decisions and remedial actions for the Sauget Area 1 Proposed NPL Site. The overall strategy for cleaning up the site is to first address soil, sediment, surface water, and groundwater source contamination through this remedial action for Operable Unit 1. Area-wide groundwater contamination resulting from the contaminated soil and groundwater source areas in the Sauget Area 1 and Sauget Area 2 sites will be addressed as a separate remedial action, which will be proposed and set forth in a separate groundwater ROD for both the Sauget Area 1 and Sauget Area 2 Proposed NPL Sites.

The remedial action proposed in this ROD will be the final remedy for contaminated soils, sediments, and surface water at the Sauget Area 1 Proposed NPL Site. USEPA's selected remedy for Operable Unit 1 consists of:

- Recovery of pooled dense non-aqueous phase liquid (DNAPL) at Site I South;
- Pulsed air biosparging (PABS) at residual DNAPL areas beneath Sites G, H, and I South
- 35 IAC §724 compliant soil or crushed rock caps at Sites G, H, I South, and L.
- Asphalt pavement cap at Site G West
- Utility relocation in utility corridor adjacent to Site H, south of Queeny Avenue
- Containment cell operation and maintenance
- Monitoring well network
- Institutional and access controls at Sites G, H, I South, and L
- No further action for Dead Creek Segments A, B, C, D, E, and F, Borrow Pit Lake, Site M, Site I North, and Site N

This selected remedy for Operable Unit 1 addresses principal threat wastes that are present on the site: pooled DNAPL below Site I South, and, subsurface soils contaminated with polychlorinated biphenyls (PCBs) and 2,3,7,8-TCDD-TEQ (dioxins) with carcinogenic risks above USEPA's principal threat waste threshold of $1x10^{-3}$ in the utility corridor along Queeny Avenue, adjacent to Site H. The selected remedy addresses these areas by treating the DNAPL recovered at Site I South through off-site incineration and by relocating the utilities in the utility corridor to prevent unacceptable risk to utility workers during excavation work.

To address the remaining low-level threat waste, engineered covers designed and managed to meet the relevant and appropriate State of Illinois hazardous waste landfill closure and post-closure requirements (35 IAC § 724.410) will be installed over Sites G, H, I South, and L. These engineering controls will be augmented by institutional controls appropriate for the Sauget Area 1 sites. Institutional controls are designed to control access to the site, manage construction or other intrusive activities that may disturb soil or waste, minimize potential exposure to COCs, and ensure that groundwater is not used for drinking water purposes.

At a minimum, institutional controls will be implemented in accordance with the Illinois Uniform Environmental Covenant Act to restrict residential development of the Sauget Area 1. Consistent with expectations set out in the Superfund regulations, the preferred alternative does not rely exclusively on institutional controls to achieve protectiveness. A detailed description of the institutional controls for Sauget Area 1 will be developed in an Institutional Controls Implementation Plan to be prepared during the remedial design process.

As presented in the ROD Decision Summary, USEPA verified that all information necessary to comply with their ROD Data Certification Checklist is present in the document.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and, utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

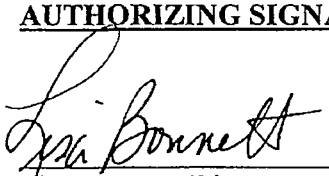
This remedy satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). The selected remedy will treat DNAPL through off-site incineration of the pooled DNAPL recovered from Site I South, and, extensive in-situ aerobic biodegradation of contaminants of concern (COCs) in areas of Sites G, H, and I South using pulsed air biosparging (PABS) systems. The PABS will target Sauget Area 1 residual contaminant areas in the middle hydrogeologic unit (MHU) and deep hydrogeologic unit (DHU). The selected remedy provides a significant degree of treatment. As many as 230,000 kilograms of contaminants are estimated to be treated through implementation of the selected remedy.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

STATE CONCURRENCE

The State of Illinois concurs with the selection of Alternative 5 from the Final Feasibility Study for Sauget Area 1. When USEPA receives the State's letter of concurrence, it will be attached to the ROD.

AUTHORIZING SIGNATURE



Lisa Bonnett, Director
Illinois Environnemental Protection Agency

9/23/13
Date